MACHINERY

DESIGN — CONSTRUCTION — OPERATION

Volume 40 NOVEMBER, 1933 Number 3

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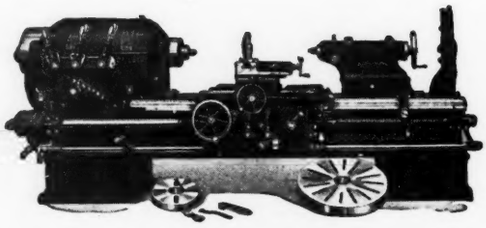

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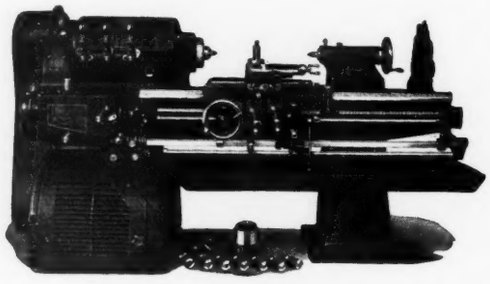

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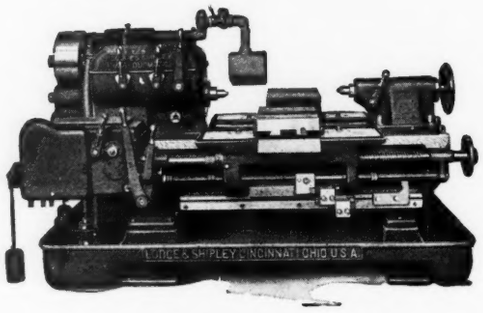

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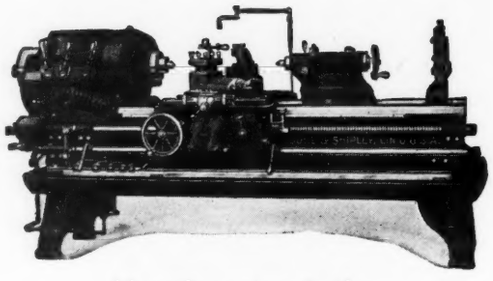

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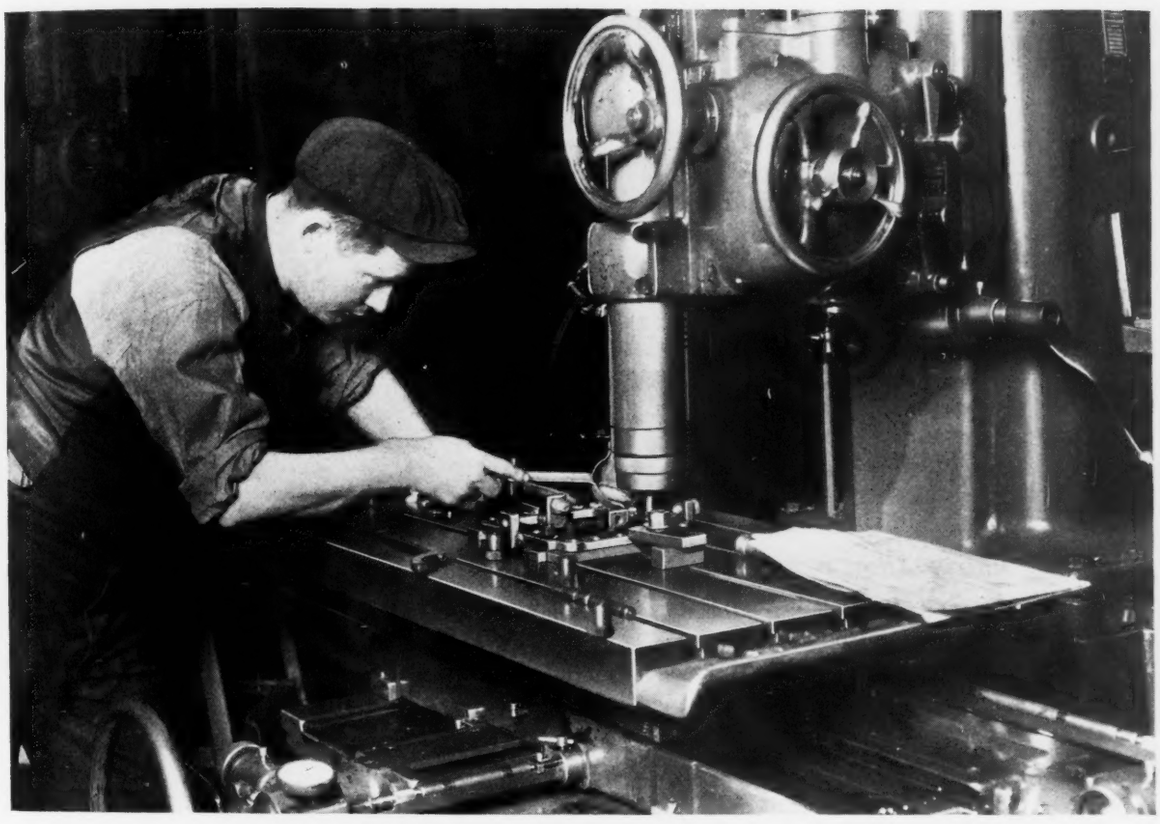
MACHINERY

Volume 40 NEW YORK, NOVEMBER, 1933 Number 3



Matrix Alloy Reduces Tool and Die Costs

By J. R. WEAVER
Works Equipment Engineer
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

MATRIX Alloy has been used for years by the Westinghouse Electric & Mfg. Co., in a limited degree, to speed up the making of dies, jigs, and fixtures and to reduce their cost. During the last two or three years, however, when the low levels of business activity necessitated that production costs be cut to the minimum wherever possible, this method has been applied extensively.

Briefly, the use of Matrix Alloy eliminates many of the extremely close operations ordinarily required in tool and die making. For example, it provides a means of accurately locating the working surfaces and members of a die relative to each other without the need of machining non-working surfaces to close dimensions. As will be explained in greater detail, the Matrix Alloy is poured into spaces that have been provided between the various parts that make up the die or other tool.

Matrix Alloy contains bismuth, lead, tin, and antimony. It has a tensile strength of 13,000 pounds per square inch and a Brinell hardness reading of 19. It melts at 248 degrees F. The pouring temperature is generally about 350 degrees F. The metal is sufficiently hard and non-shrinkable to hold

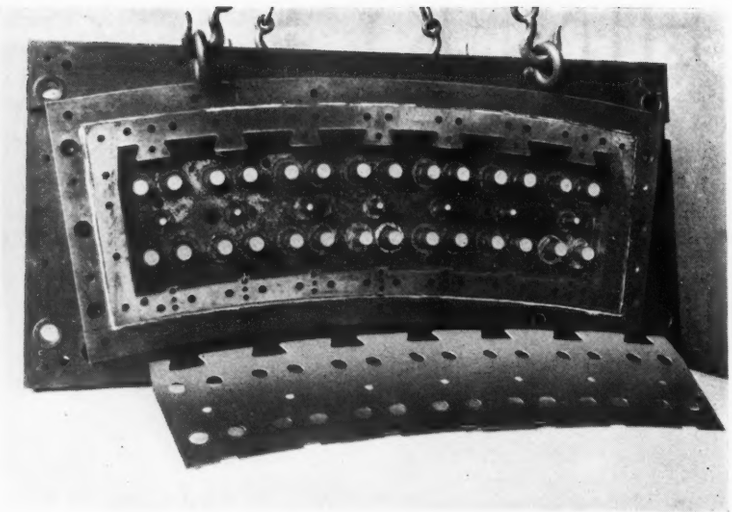


Fig. 1. Many Extremely Close Operations Otherwise Necessary were Eliminated in Making this Die Member through the Use of Matrix Alloy

Fig. 2. Matrix Alloy is Readily Poured from a Ladle into Spaces between Die or Jig Parts to Assemble Them Securely

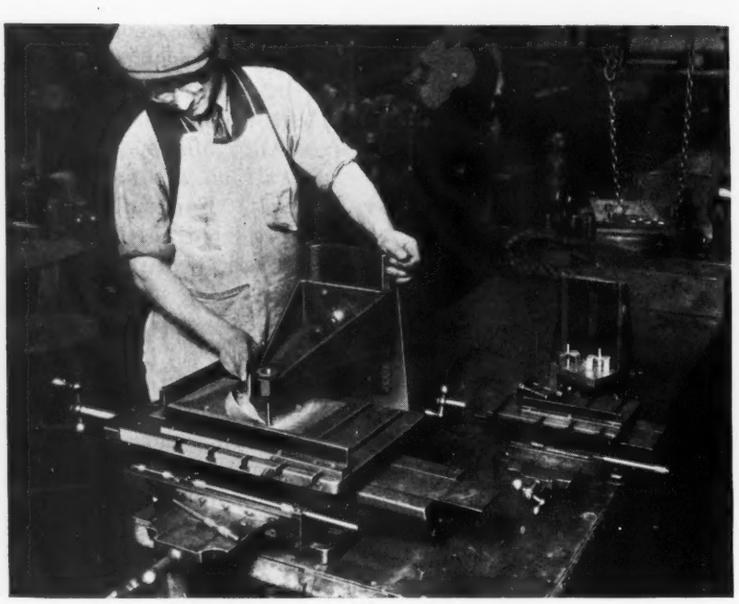


Fig. 3. A Two-way Adjustable Fixture Used for Accurately Locating Hardened Drill Bushings Prior to Pouring Matrix Alloy

dies permanently in their proper location. Also, having a low melting point, the metal has no effect on the hardness of the die. It may be obtained from the Cerro de Pasco Corporation, 44 Wall St., New York City.

How the Making of Punches and Dies is Facilitated

Considerable difficulty is often experienced in machining a punch press die to an odd contour or shape and in finishing die-shoes for properly locating the punch and die. The tool and die making method here described has eliminated much of the trouble encountered in such work. Fig. 1 shows a typical punching member of a die on which much time was saved by using Matrix Alloy. It will be apparent that no particular care was taken in machining the various locating points and cavities.

After the individual punches and other parts were completed, it was an easy matter to locate them accurately in the shoe and then fill in the spaces between the parts with molten Matrix Alloy. The alloy can be seen around each individual punch, as well as between the outer punching members and the die-shoe. From Fig. 2 it will be seen that Matrix Alloy can be poured from a small ladle like babbitt or lead.

In dies where a number of small punches must be assembled close together, one hole large enough to receive all the punches may be provided. Then, after the punches have been accurately located relative to each other in this hole, Matrix Alloy can be poured around them to hold them in place. A stripper plate can be conveniently produced for such a die by machining a hole in a plate large enough to accommodate all the punches, placing the punches in the proper position in the hole, and pouring Matrix Alloy between the punches and the wall of the hole. When the alloy has solidified, the punches can be easily withdrawn from the Matrix Alloy, thus providing a stripper plate at extremely low cost.

If some part of a die made by using Matrix Alloy must be removed from the die unit, it is a simple matter to melt the Matrix Alloy and remove the part without disturbing the remaining members of the die.

Accuracy is Not Sacrificed

Large economies have been realized in using this method in making jigs and fixtures. The holes in drill jigs and fixtures can be produced on an ordinary drilling machine by the average operator. Usually these holes are provided with hardened drill bushings, the outside surface of which is knurled to provide an anchor for the bushing in the Matrix Alloy. A groove or some other means is provided in the drilled hole of the jig to anchor the Matrix Alloy to the jig body. It can be readily seen that the rougher the hole in the jig, the better the anchorage. The anchor is necessary, because Matrix Alloy does not adhere sufficiently to steel to hold parts without some other provision.

The heading illustration shows a hardened bushing being permanently located in a drill jig by means of Matrix Alloy after the bushing has been accurately located relative to other bushings by using a jig boring machine. The accurate locating is accomplished by inserting a small-diameter arbor in the machine spindle and adjusting the table longitudinally and transversely as required. For some jigs and fixtures, use is made of the special fixture shown in Fig. 3, which has a two-way adjustment. Settings are measured accurately by means of micrometer pins and precision dials.

Hardened drill bushings with a knurled outside are made at much less cost than bushings that must be ground on the outside to an accurate dimension. The knurled bushings are made in a turret lathe or screw machine and carried in stock until needed. The use of Matrix Alloy also eliminates the fitting of bushings that is often necessary in common jig making practice, due to the fact that it is difficult to bore holes for them sufficiently uniform in size.

The actual locating of hardened drill bushings and sealing them in place with Matrix Alloy is accomplished in from five to ten minutes each, for bushings from 1/4 to 3 inches in bore diameter. The accuracy of these bushings and of their spacing has been carefully checked from time to time and found to be just as close as when a jig is made by conventional methods. This accuracy is maintained under working conditions. At no time has the position of any bushing changed due to failure of the Matrix Alloy.

Methods of Anchoring Matrix Alloy in Place

In the building of jigs and fixtures, much time is also saved because the use of Matrix Alloy eliminates the doweling usually resorted to for locating the various parts that make up the jig. Although anchoring provisions are necessary for holding the parts in place when Matrix Alloy is used, the various surfaces do not need to be machined to a fine finish, as the rougher the surface, the better the Matrix Alloy will hold. It has been found less difficult to locate the parts, as already explained, and pour the Matrix Alloy than to bolt the parts in place and provide dowels to maintain their location.

At *D*, Fig. 4, is shown a method of holding a shouldered drill bushing in a jig. A groove is provided around the outer cylindrical surface of the bushing and there is a similar groove in the cold-rolled steel plate of which the jig is constructed. These grooves form an annular pocket around the bushing that will hold it and the Matrix Alloy (indicated by the solid black) effectively in place. At *A* in the same illustration is shown a similar means of holding a jig plate in a base. In this case, the grooves run the length of the plate and base, as well as across the ends, instead of being circular.

Anchors are also used to hold die and punch parts together. However, the die-blocks and punch

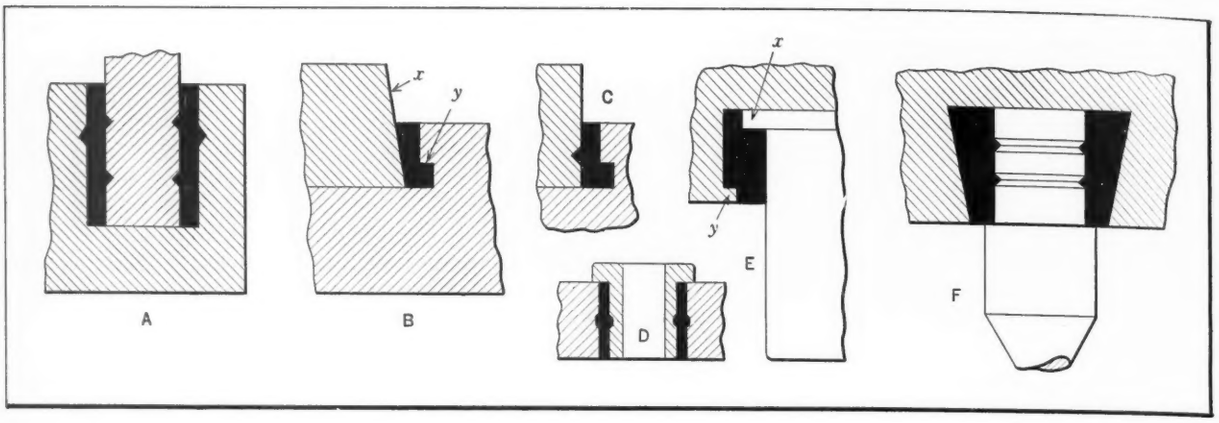


Fig. 4. Various Methods Employed to Anchor Matrix Alloy to Die-blocks, Punch-holders, and Other Tool Parts

members must always rest solidly against a steel backing-up plate, so that the impact of the punching or stamping operation is taken solidly by a shoe and not by the Matrix Alloy. This metal is not hard enough to withstand such an action. It is intended only for locating and holding punches and dies in place.

One method of anchoring a die-block in a shoe is illustrated at *B*, Fig. 4. The die-block is tapered slightly on all four sides, as indicated at x, while the die-shoe is under-cut, as shown at y, by means of an end-mill or chisel. The Matrix Alloy, as again indicated by the solid black, will hold the tapered die-block in place, while the internal shoulder of the shoe will keep the Matrix Alloy from moving. In cases where a die-block cannot be tapered on the sides, as shown at *C*, the sides can be made straight and grooves cut into them similar to the grooves illustrated at *A*.

At *E* in the same illustration is shown one method of locating a punch in its holder. A shoulder x is provided around the punch, whether it is square, rectangular, or round, and a ledge y is machined in the punch-holder. The two parts are locked securely together by Matrix Alloy. Punches can also be retained by providing one or two V-grooves on the shank, as shown at *F*, and a tapered hole in the holder. In case a tapered hole is not desirable, a ledge can be used, as in the case of example *E*.

Many other methods of anchoring Matrix Alloy can be devised by the tool designer to meet the requirements of individual jobs.

How Widely Can This Tool and Die Making Method be Employed?

The tool engineer who is really "sold" on this method will find many opportunities for employing it to save time and expense in manufacturing tools and fixtures. Of course, the method is not intended as a "cure-all" for every tooling problem. It merely furnishes an economical means of obtaining results by a method that differs considerably from conventional practice.

Latest Practice in Chromium-Plating Cutting Tools

An article in December MACHINERY will deal with recent developments in chromium-plating of cutting tools and will explain how chromium-plating is being used to increase the durability and improve the cutting efficiency of turning and planing tools, drills, reamers, and files. The author stresses the fact that the successful use of chromium-plated tools depends in a large measure on a thorough understanding of the proper design and operation of such tools. Everyone who is interested in the efficiency of cutting tools will find much valuable information in this article.

Workers' Efficiency Increased by Better Light

By DEAN M. WARREN
General Electric Co., Nela Park Engineering Department
Cleveland, Ohio

IN modern industry, better lighting makes it possible to do more and better work, which, in turn, means that better lighting is a means toward better wages. An interesting laboratory test conducted some months ago shows that the rate of work is materially increased with good lighting.

By raising the level of illumination from 3 to 12 foot-candles, the following results typical of the value of better lighting were obtained:

Classification of Workers	Increase in Rate of Work, Per Cent
Those with better eyes	14
Those with poor eyes	22
The fast workers	28
The slow workers	40

These results clearly indicate that good lighting helps to balance the inequalities in the performance of workers. It helps most those who need help most. Obviously, if it increases the working efficiency of an individual as much as 40 per cent, its value both to industry and to the workers is unquestioned.

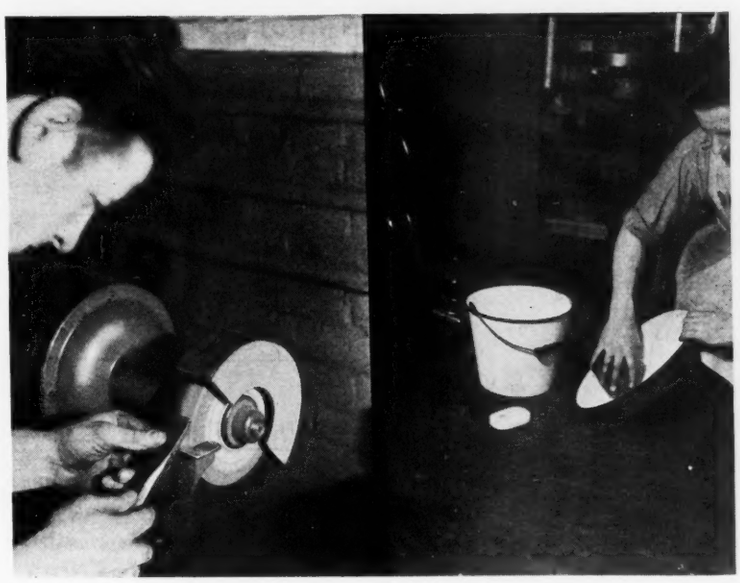
To reap the fullest benefits from a lighting system, the reflecting and diffusing equipment must be intelligently selected and located, so that the system shall not only supply more light, but shall direct the light to the best advantage. In machine shop inspection and fine detail work, there are many operations where an intensity of from 100 to 150 foot-candles will increase the accuracy and will make unnecessary repeated trips to the window that slow up production. Hence it is economy to make this amount of light available at the benches and machines where it is needed. It would not be economy, however, to have an overhead system that would light the entire shop to this degree.

An overhead installation that provides 10 foot-candles of illumination throughout the shop is recommended, with additional lighting of up to 150 foot-candles at those places where specific operations require it.

When the general lighting system provides 10 foot-candles of light, any spot in the room can be illuminated to at least ten times that amount, or 100 foot-candles, without any discomfort to the eye. Sharp lighting contrasts are to be avoided, but Dr. M. Luckiesh, widely known lighting authority, speaking on the relations of a local to a general lighting system, says: "Under all conditions, except in very rare cases, a ratio of 10 to 1 is well within the safe limits."

Influence of Voltage on the Quality of the Light of Incandescent Lamps

The constancy of the voltage of the current available at the socket plays an important part in the performance of an incandescent lamp and should be considered in planning any new lighting arrangement. One per cent change in voltage will change the light output by about 3.4 per cent; a reduction of 5 volts results in the loss of about 17 per cent in light output; and what is more important, this lost light is of a much better color quality than that remaining, which becomes yellower as the voltage is reduced and the filament temperature drops.



Just as Dull Tools Must be Sharpened to Give Best Results, So Light Reflectors Must Be Cleaned if the Maximum Efficiency is to be Obtained from the Electric Light Source

Automatic Transfer for Duplex Wire-Forming Die

By A. SUTER

THE square wire piece *W*, shown in Fig. 1, has its two ends bent, swaged, and pierced in a three-stage duplex type of die equipped with an automatic transfer mechanism. The transfer mechanism automatically feeds the wire pieces from a magazine to the bending, swaging, and piercing positions of the three-stage die. It also ejects the work from the die. Thus, one completely bent, swaged, and pierced piece is deposited in a chute or work-box at each stroke of the press.

One of the requirements of the die is that it perform the same operations on wires of different lengths. To meet this requirement, the die is made in two units, one of which is shown in the plan view, Fig. 2. The die units are adjustable along the bolster *B* by means of racks *R* and pinions *C* to suit different lengths of wire. A tongue recessed in the die-shoe and a T-slot in the bolster keep the two die units in accurate alignment. Both units are of the same construction, except that they are made right- and left-hand, the left-hand unit being shown in Fig. 2. The working punches *U*, *V*, and *P*,

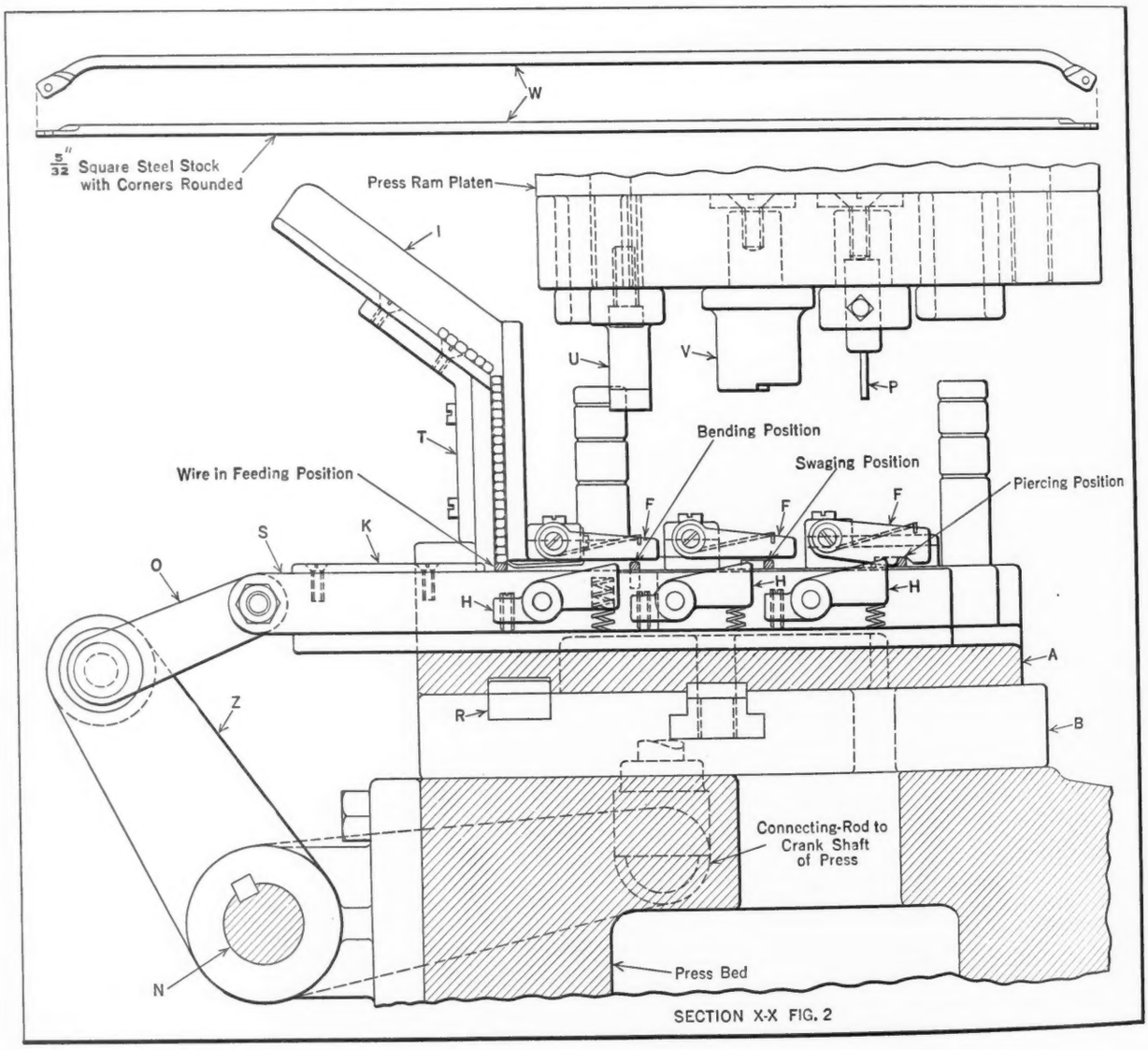


Fig. 1. Cross-section of One Unit of Duplex Bending, Swaging, and Piercing Die Equipped with Special Transfer Mechanism

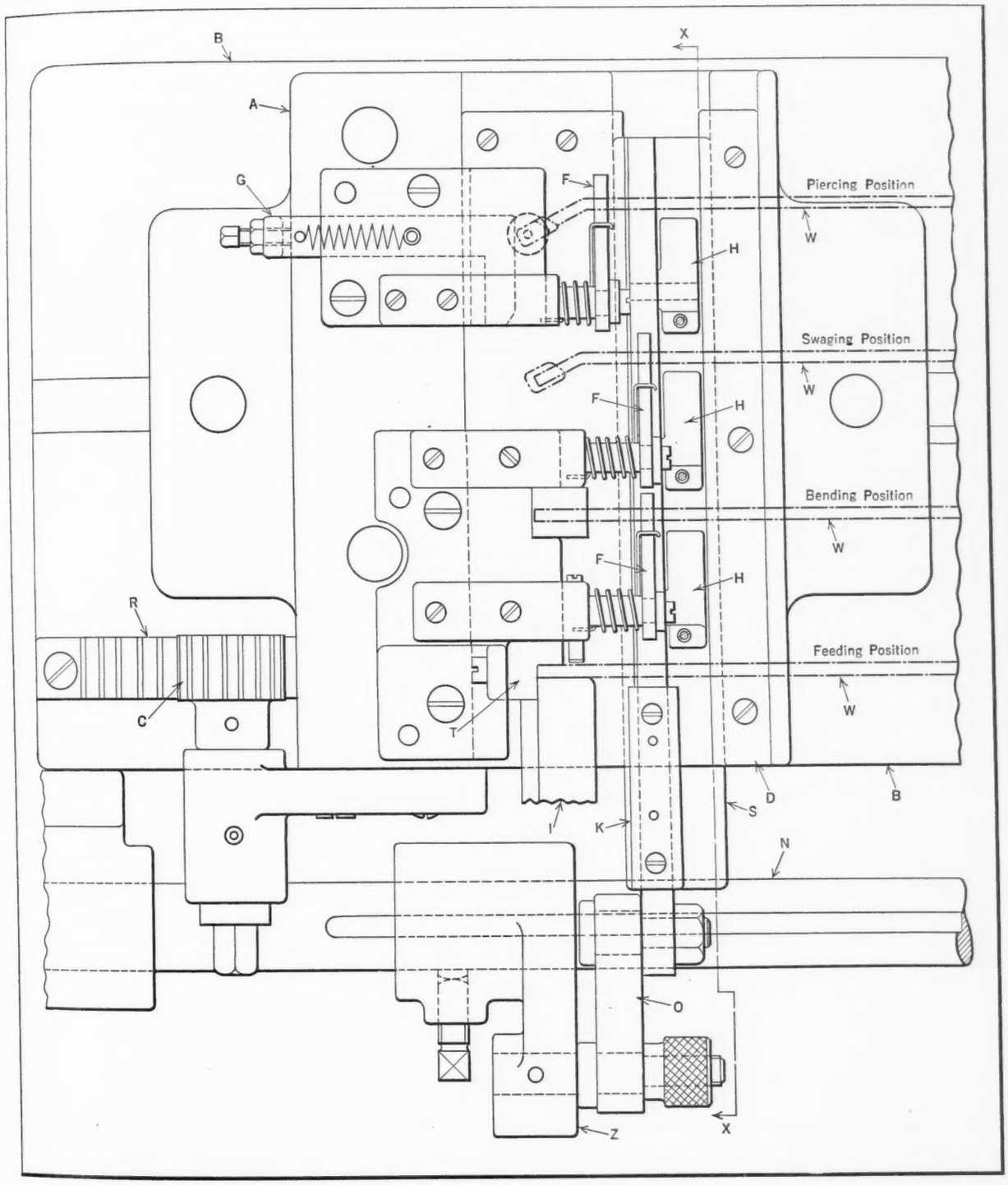


Fig. 2. Plan View of Die and Transfer Mechanism Shown in Fig. 1. A Similar Unit of the Opposite Hand (Not Shown) is Mounted at the Right on Bolster B. These Two Units Operate Simultaneously on Both Ends of the Wire Pieces W

shown in the side elevation of one of the punch and die units, Fig. 1, are of simple construction. The method of fastening these punches to the press ram platen is clearly shown.

The manner in which the wires are fed out of the magazine and successively located in the bending, swaging, and piercing positions by the automatic feed is the most interesting feature of this die. The magazine consists of two guides, one of which is shown on the left-hand die unit, Fig. 1. These guides consist of the channel *I* with an angle-iron support *T*. The side walls of channel *I* serve as gages in setting the two die units for different lengths of wire. The magazine is of the gravity type, with the feed channel *I* set at an angle, as shown, to give the operator a better view of the work. Each die unit has an individual feed-slide *S*, Figs. 1 and 2, which runs in a T-slot.

The feed-slide *S* is connected to the rocker shaft *N* by the link *O* and lever *Z*. Shaft *N* is actuated by a link connected to the crankshaft of the press. To slide *S* are attached the pusher plate *K* and the three pawls *H*. Plate *K* carries the wire out of the magazine to the first stage, or bending position, and the pawls transfer the wire to the subsequent positions. The description of the feeding operation applies to both die units.

Spring tension fingers *F* hold the moving wire down on the die surface and against the faces of the pawls, thus preventing it from being carried past the working position. The third finger *F* to the right, Fig. 1, serves also as a positive gage to position the work for the piercing operation. A notch on the under side of this finger locates the wire laterally so that the center of the swaged end is directly under the center of the piercing punch *P*. The wire is located endwise for the piercing operation by the spring-actuated gage *G* shown in Fig. 3. Gage *G* on the other die unit is clamped in a fixed position and serves as a stop.

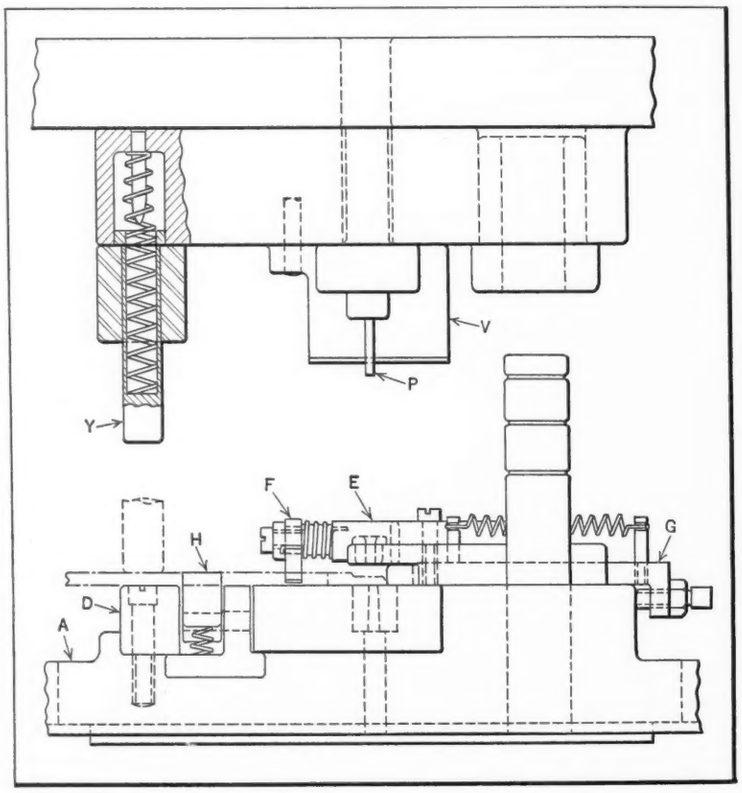


Fig. 3. Rear Elevation of Die Illustrated in Fig. 1, Showing One of the Three Plungers Y (Omitted in Fig. 1 for Sake of Simplicity). These Plungers Clamp the Wires to Blocks D on the Return Stroke of Slide S, Fig. 1

One of the features of interest in the operation of this die is the manner in which the wire is made to turn one-quarter revolution on its axis when moving from the bending to the swaging dies. In the bending position (see Figs. 1 and 2), the ends of the wire are bent downward at an angle, as shown in the upper view of the work *W*, Fig. 1. When the wire is carried forward to the swaging dies, the bent-down ends come in contact with the side walls of the die recess, which causes the wire to turn into the proper position for swaging.

Spring-actuated plungers *Y* (shown in Fig. 3, but omitted in Figs. 1 and 2) hold the wire in place during the return stroke of slide *S*. The pawls *H* are depressed below the die surface on the return movement of the slide and snap back into position behind the wire to be transferred.

In operation, the press runs continuously at 60 revolutions per minute. The magazine is refilled while the press is in operation. Although the die described has been in operation for two years, it has only been necessary to redress the swaging tools and renew the piercing punches occasionally.

* * *

Uniform Cost Systems

In the introduction to the "Denham Universal Code of Standards of Practice for Industrial Costing and Pricing," prepared by Robert Scudder Denham, chief engineer of the Denham Costfinding Co., Cleveland, Ohio, it is pointed out that "uniform" cost systems are not practical for use in "multiform" factories. To be practical, a cost system must be designed to meet the special requirements of the factory in which it is to be used. There are no two factories alike. However, there are universally applicable fundamental principles that can be applied to all cost systems. These bear the same relation to a costing system that the principles of applied mechanics bear to a machine or mechanical device.

Cost systems may be designed, established, and operated in conformity with these principles, but their efficiency, like the efficiency of a machine, depends entirely upon the skill of the men who organize the system and prepare the instructions. The success of a machine also depends upon the skill of the man who operates it, and so the success of a cost system depends upon the judgment of the clerks who operate it.

* * *

The buggy and the stage coach cannot meet the needs of the motor age—nor can the economics of the past century solve the problems of this.

Synthetic Plastic Materials

Their Characteristics and Application

A Review of Different Types of Plastic Materials Available, and an Outline of the Methods Used in Their Production — First of Two Articles

By HERBERT CHASE
Consulting Engineer, New York

A LARGE variety of plastic materials is available. Each material has properties that differ in some respect from those of the others. Nearly all are available in different grades and types that have been developed to meet a variety of requirements. Many of these materials can be had in the form of sheets, rods, and tubes that are suitable for machining in much the same way as metals. The most widely used type is that designed for molding into the final finished form, starting with a powdered, granular, or chip-like charge which is subjected to heat and pressure in the mold cavity.

In general, parts molded in this way come from the mold in practically the finished form, usually with a high and permanent gloss to which no enamel or other finish need be applied. As the molding process is quite rapid and pieces can be given a complex form that could not be produced economically by any other means, except in certain cases by casting, it is apparent that molded parts have unquestioned advantages from a cost standpoint.

Many Desirable Properties Give Plastics Wide Range of Application

Although plastic materials are not so strong as most forms of metal, they do possess considerable strength. They are lighter in weight than any common metal, and are sufficiently hard, in most cases, to take the place of metal parts. In some instances, they are shock-resistant, as well as resistant to abrasion and to moderately high temperatures. Many types are non-inflammable, some are non-combustible, and a few possess refractory qualities and are used at temperatures up to or above 1500 degrees F. Most forms are corrosion-resistant, and many are resistant to oils and have good bearing qualities. The most used forms are resistant to mild alkalies and dilute acids, and have fairly low water-absorption and good waterproof qualities.

All forms of plastics have dielectric qualities, and some of them are equal, if not superior, in this respect to the best of natural insulating materials, such as amber and quartz, which are much more expensive. In fact, it was as insulating materials that plastics first became known. Many designers and engineers who have previously thought of plastics simply as materials to be used when some electrical application is under consideration are just beginning to realize the advantages gained by using these materials for many other applications.

Finally, most of the plastics are available in attractive colors and so are often applied when a decorative or a combination of utility and decorative effect is desired. In many instances, combinations of plastics and metals produce effects of such beauty and sales appeal as are rarely realized when either is used alone.

It will therefore be seen that the plastics present many advantages. The product designer or producer who does not make the most of these qualities handicaps himself in comparison with those who use plastics in applications for which they are suited.

Classification of Plastic Materials

Plastics are usually divided into two general classes. The type commonly termed "thermo-setting" or "thermo-reactive" undergoes a chemical change when heated to the curing temperature in the mold. This change usually results in permanent hardening and in making the material infusible and insoluble, and is not reversible.

The "thermo-plastic" type, on the other hand, does not undergo a chemical change when molded. It is merely softened by the application of heat and solidifies again when cooled below a certain temperature. Moldings made from this type of material can be remolded again when heated, and any flash formed is usually mixed with a subsequent charge; hence there is practically no waste.

These classifications are not all-inclusive, as they do not take account of the refractory type of cold-molded materials which depend upon a cement or similar binder that does not require heat for hardening, although heat accelerates the hardening action. In some cases, also, certain plastics are softened for forming by wetting with a solvent which is afterward evaporated, leaving the plastic hard, no heating being required. These, however, may be regarded as rather special cases. All the commoner resinous materials, both natural and synthetic, are either thermo-plastic or thermo-setting.

Most prominent among the thermo-setting plastics is the *phenolic* type, which is used extensively for both mechanical and electrical (dielectric) applications. After being molded, this material is

hard, heat-resistant, and highly resistant to chemical reaction. Though available in light pigmented colors, it is most widely used in black and brown.

Hard rubber, another thermo-setting plastic, is less heat-resistant and is softened by heating above certain temperatures, though it does not revert to its original state. It is quite combustible and also supports combustion, whereas phenolics, although charred by high temperatures, do not burn readily and do not support combustion.

Urea plastics are also in the thermo-setting class. Their chief advantage is their availability in light translucent forms which do not darken. The plastics included in this class are less resistant to heat and to water absorption than the phenolics.

The thermo-plastics include cellulose acetate, cellulose nitrate, a new rubber-base product, some vinyl and styrol compounds, shellac and a few other materials, the latter mostly in a more or less experimental state. Only those named are dealt with here. All the thermo-plastic materials are less heat-resistant than the phenolic and urea thermo-setting plastics, but all except shellac are available in very beautiful transparent and translucent, as well as opaque colors, which accounts for their use in many applications. They are highly resistant to moisture and to some chemicals, and some have exceptional dielectric properties. Some are practically non-combustible, others burn slowly, while cellulose nitrate burns explosively.

Ash Tray, Aviation Meter Case, and Oil-bottle Spout and Cap, Made from Bakelite Corrosion-proof and Heat-resisting Materials by the Boonton Molding Co.

By far the most widely used of the modern plastics are those of the phenolic type. These include Bakelite, Durez, Resinox, and Textolite. These are made in a variety of forms for molding purposes, in which several different fillers such as wood flour, asbestos, mica, and fabric are employed. There are, of course, many laminated phenolic and other plastics not mentioned here, as this article deals primarily with molded and cast forms. The molding materials are available in different degrees of plasticity to suit different molds. Those referred to are phenol-formaldehyde types. The phenol-furfural type has similar qualities. One form is termed Durite.

Cast phenolics have been sold under the names Catalin, Crystillin and Marblet, chiefly in the form of rods and tubes, for machining into useful forms. Cast phenolics are not designed for molding.

The molded forms of phenolic materials have quite high tensile and bending strength, but except in the fabric-filled type, their impact resistance is not high—that is, they are somewhat brittle. They are better in this respect, however, than some of the other plastics. In resistance to heat, they are among the best of the plastics and are not softened by the application of heat. Most, if not all grades, withstand temperatures up to 300 degrees F. without injury, and the asbestos-filled type is reported to withstand temperatures up to 500 degrees F. In general, however, exposures to sustained temperatures much above 400 degrees F. are not recommended.

Molded phenolic materials are quite resistant to weak acids, alkalies, oil, and water. Neither oil nor water has any pronounced mechanical effect, but some water is absorbed, the proportion being greater in humid atmospheres than in actual submersion. The dry material has excellent dielectric qualities, but water absorption reduces the surface resistivity quite rapidly, though not to a point where a breakdown occurs in most applications.

Arc resistance is not so high as for some other plastics, and the occurrence of an arc is likely to leave a surface trail of carbon which may result in subsequent electrical leakage. Much the same is true, also, of most plastics containing organic substances; hence, binders of inorganic materials are preferred in cases where high arc resistance is an important feature. When unusual shock resistance is required in phenolic molded parts, the type having a fabric filler is usually chosen, as its shock resistance is several times that of the ordinary wood-flour-filled type.

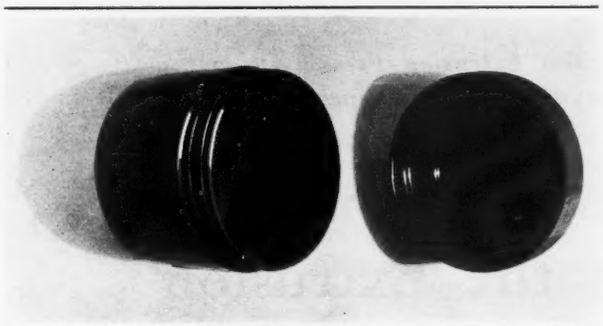
Phenolic molding, in common with most other plastic molding, requires heavy press equipment. The pressure recommended ranges from 1500 to 5000 pounds per square inch, but pressures above 2500 pounds per square inch are seldom required, except for fabric-filled materials. The molding temperature recommended is 300 to 350 degrees F. The molding time depends upon the material used and the thickness of section. It usually ranges from three to four minutes for sections 1/4 to 1/2 inch thick. To this time must be added that required to fill the mold, close it, open it, and remove the piece. If inserts are to be molded in place, as is often done, the time to insert these must be considered.

The parts are sometimes allowed to cool in the mold, when the dimensions must be accurate, but this is not often required. Sections as thin as 1/32 inch are sometimes molded, and sections up to 1 inch or more in thickness are readily molded if

proper curing time is allowed. An allowance varying from 0.001 to 0.008 inch per inch for shrinkage on cooling, upon withdrawal from the mold, is usually made. The smaller figure applies when a mineral filler is used and the piece is allowed to cool in the mold. Warpage, blistering, poor finish, and inferior dielectric qualities are probable results of under-curing.

Colors Available in Phenolic Materials

Although brown and black are the most used colors in molded phenolic materials, a large variety of colored materials is available. Light pastel shades can be produced with heavy pigmentation, but they are inclined to darken with age and exposure to light, as the resin itself darkens. This applies primarily to molded materials which, in general, are made with about equal parts of filler and of resin, and are opaque. Cast materials can be had, however, in many light and bright colors, and in translucent or transparent, as well as in opaque forms, many of which have beautiful marking. Mottled and other effects, produced by mixing compounds of different colors, are available in both cast and molded forms.



Jar and Cap Made from Durez Moisture-resistant Material by the Boonton Molding Co.

Cold-molded plastics differ from other types, not alone in composition, but in the method of molding which, as the name indicates, is done without the application of heat. The compounds used are also moist rather than dry. As curing is not done in the mold, the latter is employed only to shape the piece, which is then ejected in a highly compressed form, and is subsequently baked in ovens designed to accommodate trays filled with large numbers of pieces.

The molding is done very rapidly, usually with a tamping or percussion action, but in some cases with a slow-acting press. In all cases, however, the final pressure is high, reaching 8000 pounds per square inch in some instances. In general, single-cavity molds are employed. It is rarely necessary to use multiple-cavity molds to obtain a high rate of production per press; hence, the mold cost is reduced. The cold-molding process is sometimes more economical than hot molding in over-all cost, especially on short-run jobs, because in the latter it is often essential to use multiple-cavity molds to obtain an economical production rate, and such molds may not be justified unless a large quantity of parts is required.

The mixtures used for cold molding vary widely, but there are three general types of binder, the filler usually being asbestos fiber. Asphaltic or pitch binders are used for one type of material, phenolic resin for a second, and Portland cement or silica-lime mixtures for a third. The type containing an asphaltic binder is low in cost and resistant to temperatures as high as 450 to 600 degrees F., but is combustible and less resistant to moisture than the type having a phenolic binder. The latter is stronger, but considerably higher in cost.

The third type of material is refractory. That having a Portland cement binder is usually recommended for temperatures up to 1500 or 1800 degrees F. and the silica-lime type for temperatures up to 2000 degrees F. Of the two refractory types, the former is the stronger. Both types are somewhat porous and absorb considerable water which, of course, lowers their electrical (especially surface) resistivity, but moisture-resistant impregnation or surface finishes are sometimes used to advantage.

As the qualities mentioned indicate, the cold-molded plastics are used chiefly when heat resistance is required or in applications where the first cost, including the die cost, is lower than for hot-molded types. In well organized shops, the lack of uniformity in physical qualities once characteristic of this form of molded product has been overcome by close control of certain variables.

The physical strength is generally lower than for phenolic hot-molded plastics, but this disadvantage can sometimes be offset and lower cost still retained by using thicker sections, when increased weight is not detrimental. Although the specific gravity is higher and the finish duller than for hot-moldings, this is of little or no consequence in many applications, and the same may be said of color, which is quite limited (usually black and gray).

Although some purely mechanical applications of cold-molded parts are made, the great majority of applications involve either some electrical or heat-resistant part, such as heater plugs, switch bases, panels, arc shields, separators and barriers, or forms for holding resistance elements and the like. Inserts of metal are readily molded into parts of this kind. Most of the molders of this type of plastic mix their own compounds. Some of the trade names of cold-molded materials are Gummon, Tegit, Hemit, and Cetec.

A coming number of MACHINERY will continue this review, dealing with rubber-base and urea plastics, and will briefly discuss other plastics, such as shellac, casein, nitro-cellulose, cellulose acetate, and styrol, vinyl, and glyptal plastics.

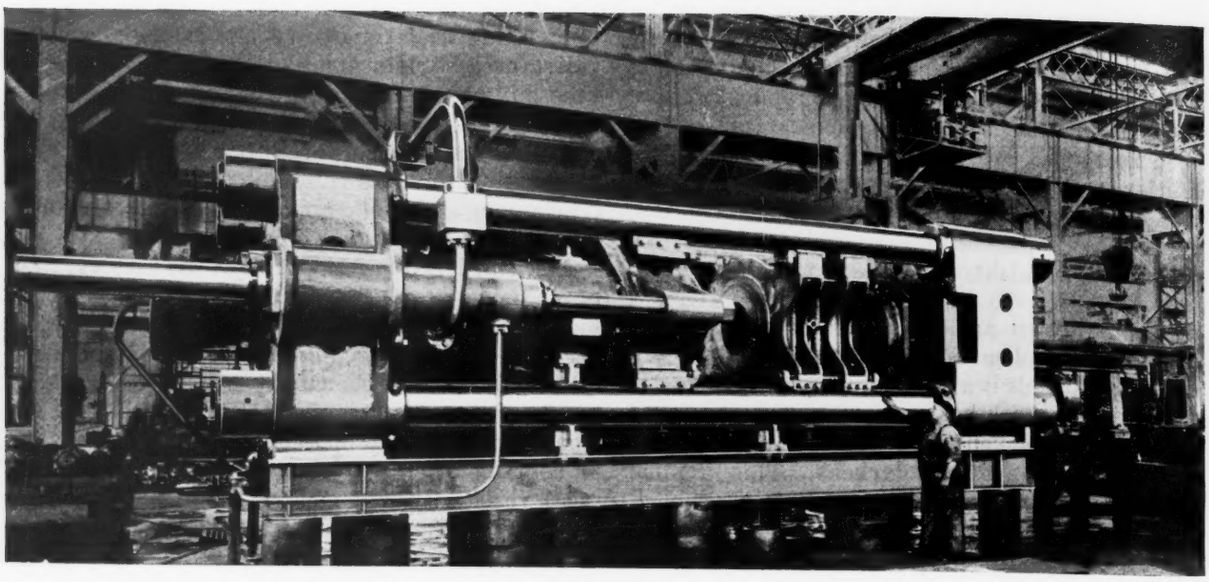


Fig. 1. Four Thousand Ton Extrusion Press Used for Forming Aluminum and Brass Shapes

Forming Aluminum and Brass Products by the Extrusion Process

By J. B. NEALEY

Methods and Equipment Used in Producing Extruded Shapes by Forcing Hot Aluminum through Dies at Pressures from 200 to 4000 Tons

WHILE various methods of forming aluminum products are in use today, there are some parts that can be made economically only by the extrusion process. These include structural shapes, such as I-beams, channels, etc.; window molding for automobiles, buses, and building construction; and hollow sections, such as pipe. The extrusion process consists of forcing hot aluminum billets through dies with pressures ranging from 200 to 4000 tons. The smaller presses used for this purpose are of the vertical type, and the larger, of the horizontal type, such as shown in Fig. 1.

Solid sections are made by simply forcing the metal through the die aperture, while hollow sections are formed by placing a mandrel in the die and forcing the metal around the mandrel. Solid billets are employed for solid sections and hollow billets for hollow sections. Billets up to 14 inches in diameter and 35 inches long are generally used. The hollow billets are either cast in that form or produced by piercing solid billets.

One of the world's largest extrusion presses is in use at the plant of the Bohn Aluminum & Brass Corporation, Detroit, Mich., extruding both aluminum alloys and brass. It takes billets from 12 to 16 inches in diameter and has a capacity for 11 tons of aluminum or 20 tons of brass per hour. In the extrusion division of this plant are several presses of different sizes and several furnaces in which the billets are heated. The aluminum or aluminum-alloy billets are heated to 875 degrees F., and the brass stock to 1400 degrees F.

Method of Heating Billets to be Extruded

The heating furnaces are of brick construction, steel encased, and held together with structural steel work. These furnaces are continuous in operation and automatic as to temperature and time control. One, which is used interchangeably for heating aluminum and brass, is 60 feet long, 10 feet wide, and 9 feet high. This furnace is heated by sixteen gas burners firing below the work and five firing above on one side, and the same number of burners, similarly arranged, on the other side. Two lines of billets pass through this furnace abreast, tracks being supplied for each line. The rails consist of U-shapes or channels, with rollers spaced close together in the channels for the work to ride on. These tracks are supported on firebrick piers.

Spacer shoes are placed lengthwise on each track and trays carrying the billets are loaded on the spacers. Two pneumatic pistons with wide pusher heads, one for each track, push the entire load through the furnace. The billets are brought to the charging end of the furnace on skids by lift trucks.

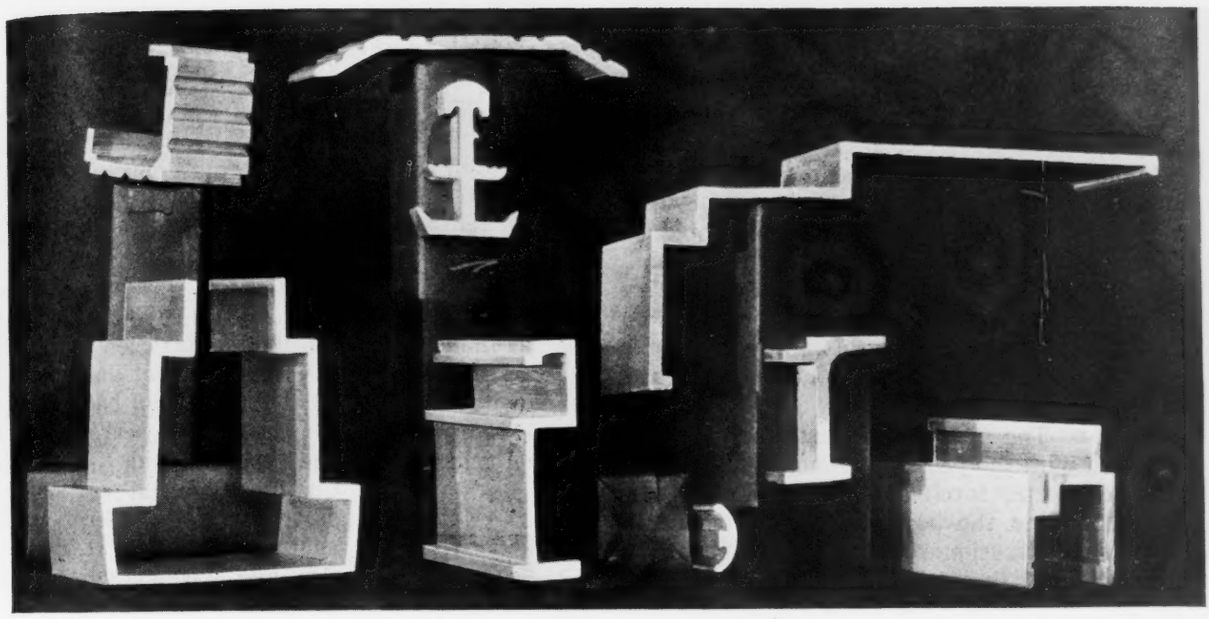


Fig. 2. Typical Aluminum and Brass Shapes that have been Produced by the Extrusion Process

An overhead monorail, with hoist, is used to return the spacer shoes and trays from the discharge to the charging end.

The correct temperatures in this furnace are automatically maintained through a potentiometer controller system. The fuel to the burners is exactly proportioned for complete combustion through the use of a venturi throat, pressure air being supplied which inspirates gas in the desired ratio. This gas has previously been dropped from line to atmospheric pressure. The air is raised to the proper pressure with a blower and the temperature control is effected by regulating a motor-operated valve cut into the air supply line.

Through the use of a thermo-couple and a potentiometer this valve is opened and closed intermittently in response to a furnace temperature rise or drop relative to the degree set on the indicator. In this manner, the volume of fuel supply to the burners and furnace is increased and decreased so as to maintain a constant temperature in the furnace.

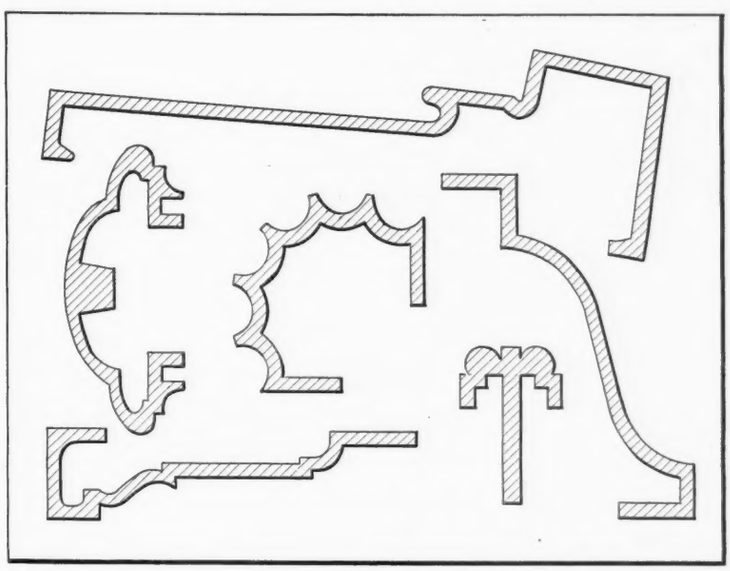


Fig. 3. Cross-sections of a Variety of Extruded Shapes

The press served by this furnace was built for a capacity of 4000 tons, and does away with the annealing process, as the extrusion is completed in a single operation. Pickling is also unnecessary, except when a special finish is desired. The pressure chamber is made of a special alloy steel and is surrounded by a combustion chamber, fired with gas burners, to keep the billets from chilling through contact with cold steel. For the same reason the dies are also kept hot. The dies are first preheated in a separate gas-fired furnace, about 4 feet square, which is equipped with an automatic temperature control similar to that already described.

A feature of this extruder is that solid billets can be used in it to produce hollow sections. A piercing ram is built into the unit which pierces the solid billets in the container, and the extrusion ram does the work. In extruding some sections, misalignment due to expansion of various parts of the press creeps in. While this is only a few thousandths of an inch, it is corrected, in this particular

press, by special attachments affixed to such parts. Furthermore, various other devices can be mounted on the moving parts to keep the piercing plunger perfectly concentric with the die.

One of the greatest difficulties heretofore encountered in machines of this type has been the removal of metal waste remaining in the pressure chamber after the extrusion operation has been completed. The metal forced between the joints by the high pressure solidifies. To eliminate this, the pressure chamber of this big press was designed to move on four guide rods between the head and the hydraulic cylinder. A tapered hole in the head end of the pressure chamber exactly fits the correspondingly tapered dies. The piston of an auxiliary cylinder is connected with the pressure chamber and moves it back and forth, forcing it against the die at the beginning of the extrusion. The tapered hole and the tapered end of the die form such a close fitting joint that no metal can be forced out between the two surfaces.

When the billet has been extruded, the auxiliary cylinder operates the pressure chamber in the opposite direction, thus opening a space between the pressure chamber and the die so that the surplus metal can be easily removed from the top of the die. A long cast-iron table supports the extruded forms, and between this table and the back edge of the machine there is a 30-ton cutting-off press which severs the ram stump of the billet from the die-block. A change-over device permits the use of either the direct or indirect method of extrusion.

Forging stock is also extruded in the form of regular or irregular shaped bars, which are cut to length with a band saw. The cuts are made on each side, but only for a third of the thickness in each case, leaving a third of the thickness in the middle, which is broken off. This method is used so as to leave a fracture which can be inspected for inclusions or other defects, and if a pipe shows, the end is cut back until a clean fracture appears. Also, sections are frequently cut from the bar and pulled in tests for strength.

* * *

If the engineer can apply his analytical methods to the vague theories of economics, and develop the basic facts through his more intimate knowledge of industry, he can indeed become a most useful factor in public life.—*Dexter S. Kimball, Dean of the College of Engineering, Cornell University*

Paul Doty Elected President of the A.S.M.E.

Colonel Paul Doty, chairman of the Minnesota State Board of Registration for Architects, Engineers, and Land Surveyors, has been elected president of the American Society of Mechanical Engineers for the year 1934. Colonel Doty was born in Hoboken, N. J., in 1869. He graduated from Stevens Institute of Technology in 1888 and entered the gas industry, with which he has been identified most of his life. He was vice-president and general manager of the Consolidated Gas Co. of New Jersey from 1895 to 1898, when he became secretary and general manager of the Grand Rapids Gas Light Co. Later he held positions as secretary and general manager of the Detroit City Gas Co. and vice-president and general manager of the Denver Gas & Electric Co. In 1904 he became vice-president and general manager of the St. Paul Gas Light Co. and the Edison Electric Light & Power Co. He has been president of the Michigan Gas Association and the Western Gas Association.

Colonel Paul Doty, Newly Elected President of the American Society of Mechanical Engineers

In 1917 he entered the service of the United States as major in the Corps of Engineers. He is now lieutenant-colonel of the Reserve Corps of the U. S. Army. He has also served as brigadier-general of the General Staff Corps, Minnesota National Guard.

Colonel Doty became a junior member of the American Society of Mechanical Engineers in 1891 and a member in 1904. He has served as chairman of the Committee on Local Sections and as a manager and a vice-president of the Society. He now represents the Society on the American Engineering Council. He is a member of the American Institute of Electrical Engineers and of the Society of American Military Engineers.

* * *

According to *The Locomotive*, pulverized coal is being transported in pneumatic pipe lines for considerable distances at some German power plants. For distances shorter than about 1200 feet, the material is ordinarily drawn through the pipe by suction; but for longer hauls—up to 6000 feet—compressed air is employed. Since the mixture of air and coal dust introduces an explosion hazard, especially with easily ignited coal, an inert gas, such as flue gas, is sometimes used instead of air.

Industrial Management Based on Common Sense

An Executive of Broad Experience Outlines His Methods of Dealing with Employes and Obtaining Their Cooperation

By FRED J. MILLER

Formerly General Manager, Remington Typewriter Co. and
Past President of the American Society of Mechanical Engineers

FOLLOWING considerable experience in various kinds of machine shops, my occupation became, for twenty years, one that caused me to visit a great many machine shops here and abroad. I then met and talked mostly with owners or higher executives. I found some of them who seemed never to have any difficulty with their help, and a great many others who had plenty of it. Naturally, I gave considerable thought to this; and when, years afterward, I unexpectedly became general manager of a scattered group of factories belonging to one company employing about 5000 people, I was guided largely by that thinking.

The Editor of MACHINERY, after a discussion of industrial affairs at a meeting of the American Society of Mechanical Engineers, in which discussion I participated, asked me to state briefly my philosophy of industrial management. I think I can best do this by relating certain happenings and how they were handled; but, briefly, my philosophy is based upon the following general propositions:

1. That if employers, bankers, politicians, and pretty much everybody else can have their organizations for joint action in their interest, then working people may properly do the same.
2. That we can employ no angels, but must be satisfied with plain human beings as we find them.
3. That most people, whether employers or employes, can be reasoned with and gotten along with without being clubbed into submission, and the results thus obtained are very much better.
4. That it is clear that both employers and employes will be better off in every way when they come to a reasonable agreement based upon sound business principles and the "live and let live" policy.

The Principles upon which Satisfactory Relations Between Employer and Employe Must Rest

At the beginning of my work, it was made clear that all that would be expected or required of any worker would be faithful performance of his duties during working hours without propaganda for unions or anything else not pertaining to the work in hand. Outside of working hours, employes were to have all the privileges of American citizenship. They might enjoy or employ themselves in any way they liked, and organize a new union every evening if they felt they needed it.

We tried to have it understood that the company intended to be fair and that if any employe had a grievance, or thought he had, he had a standing invitation to discuss it with the proper authority representing the company; and this applied to groups of employes as well.

Not only would we allow such things, but we invited them, because as nearly as possible, we wished all our employes to be happy and satisfied. If they were not, then we wanted to be the first to know about it; and the letting us know might be done by individuals, groups, or committees representing groups, freely chosen by the employes concerned—union or non-union.

All such representatives were to be treated fairly; no browbeating, no blacklisting, no accusations of "troublemaking" or of being "troublemakers." The case of the employes was allowed to be fully stated without interruption or haggling.

In the very rare cases in which a satisfactory agreement could not be reached, there might be a contest or a strike. If so, then there was no abuse. We conceded the right of employes to endeavor to better their condition and to seek other employment where they thought they might be better off; and when they tried this and were disappointed, or for any reason wished to return to us, we took them back, if we could, for reasons that ought to be obvious to any employer who really thinks about such things.

How the Plan Worked out in Practice

After about a year of adjustment and realignment, so to speak, among the factory executives, the late Mr. Gantt was employed to unify the machinery of administration throughout the factories, in preparation for a complete detailed study of operations. This was notably successful, and there was practically no trouble about it. Things were not rammed down our employes' throats, but business-like propositions were made to them, which were usually accepted. When not accepted, no coercion was attempted; there were always some who were ready to accept, and the work went on until all were convinced that it was fair and mutually advantageous, designed to secure, as it did secure, free and hearty cooperation for mutual benefit.

Costs were reduced; many thousands of dollars were saved by omitting previously thought-to-be-

needed additions to factories and equipment. The employes got materially higher wages and were just as comfortable at their work—often more so. Though we had one rather extensive strike of screw machine operators and toolmakers in two of our factories located in the same city, we avoided all denunciation and accusations. This strike was, in a sense, forced upon our people by the national organization to which they belonged. The polishers were to have been in it also; but, curiously enough, they changed their minds. Instead of following our suggestion to appoint members of their own group to discuss the matter with us before the time set for the strike, the polishers were represented by an outside man—an officer of the union—a very strong union, by the way. When this man called and his card came up to the office, he was not told to be gone, as he was "not our employe," but it was taken for granted that he represented the men and would be backed up by them; that he was the accredited representative of our polishers in both factories. We regretted this, thinking it would have been much better to talk with our own men. Events showed that we were mistaken about that.

The man was invited into the office and asked to take a seat at a conference table and state the case for the men whom he represented. This he did without interruption or comment until he had entirely finished and said that he had. Then our side of it was stated, and after some further go-as-please talk, he departed.

The next day was set for the beginning of the strike. The polishers, much to our surprise, did not join in it, and we learned that their representative, at a meeting called the evening before, had said, in effect, that he had never before met employers as fair-minded, candid, considerate, and well disposed toward their workers, and he advised them to stick to their jobs; they took his advice. I was not present at these meetings, but they were conducted in accordance with previously agreed-upon plans.

The strike did not last long; and with few exceptions, if any, all our experienced and trained men were back with us as before, without concessions by us, though before the date of the strike we had voluntarily reduced our working hours by five hours a week, which was one of their demands.

Another Case where Common Sense Saved the Day

In another of our factories located in a New England city where, at the time, strikes were epidemic, some of them accompanied by violence and bloodshed, brought on by changes in economic conditions during the war, a group of girls suddenly struck as a result of mistakes made by certain of our local executives. Their leader telephoned to me in New York, asking if they could see me. Next morning, I was at the works; and after talking with the acting manager, the regular manager being in a hospital at the time, I was convinced that it was our mistake.

I then met the young women and tried to get them to cooperate in having a new study made of the job. They were polite but firm, and would have nothing more to do with "that red-headed time-study man." I did not tell them that a mistake had been made, but said that "there might have been one." The situation looked serious. One entire line of the factory's product passed through their highly trained fingers.

That night, I wrote a letter to the local manager emphasizing that we always wanted to be the first to know about any troubles among our employes and would defray any expense involved in letting us know about them, on the ground that it was factory or company business. Therefore, I wished him to identify the girl who had telephoned me about the trouble and reimburse her for the expense of the long-distance call.

In a day or two he replied that he had not known who the girl was and had, therefore, asked them all to come to the factory. There he explained what he wanted and read my letter to them, after which they all returned to work. The job was restudied with proper supporting conditions, and "peace and prosperity blessed the land."

* * *

Work of the Machinery Institute

Over fifty trade associations, representing manufacturers employing at the present time 180,000 wage earners, are now members of the Machinery and Allied Products Institute, 221 N. LaSalle St., Chicago, Ill., the aims and purposes of which were described in considerable detail in September MACHINERY.

One of the important activities of the new Institute is the establishment of close cooperation with other associations in order to avoid complications in the preparation of codes. The Institute believes that each manufacturer should operate under one code applying to the manufacture of a particular product. For instance, a pump manufacturer should operate under the Hydraulic Code, and not under association codes covering castings, valves, patterns, or other products involved in the building of pumps. Cooperation has been secured from various foundry and other associations to exclude process manufacturing from their codes, thus eliminating the necessity for a manufacturer to operate under a large number of association codes, with possible subsequent complications.

The Institute has also directed much of its effort toward an educational program to bring about an understanding of the problems of the capital goods industries, emphasizing that there is no hope for permanent recovery from the depression until the unemployed in the capital goods industries are back on the payroll. Facts along these lines have been presented to officials of the National Recovery Administration for consideration in connection with machinery association codes.

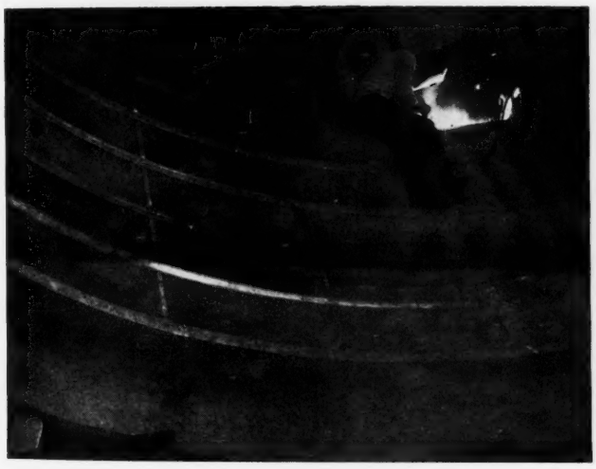
Notes and Comment on Engineering Topics

The state of Nevada has the largest number of motor vehicles in proportion to its population of any state in the Union. In Nevada there is one motor vehicle registered for every 2.86 inhabitants. California and the District of Columbia rank next.

Improvements in railway service are reported from Russia. A special train has been placed in service between Moscow and Nizhni—a distance of 275 miles, which is being covered in about seven hours. This train is equipped with the very latest innovations. A special club car contains a large reading room and library, as well as a motion-picture room. The train is equipped with radio receivers, and station stops and other announcements are given to the passengers by radio. The train is also equipped with telephone service, so that a passenger in one car can telephone to one in another part of the train. The rolling stock was built by the Voitovich shops in Moscow.

An electric clock which has large numerals visible through small windows in the front plate instead of a dial with hands, has been developed by the General Electric Co. Time is read directly in hours and minutes, and the second hand is replaced by a rotating dial which indicates the time in seconds. The numerals are illuminated by a small Mazda lamp which provides sufficient light to read the figures in the dark. The clock is operated by a small synchronous motor connected by a gear arrangement to three revolving wheels having numerals indicating the time. There are no complicated moving parts, and no oil or attention is required.

A hundred years ago, it was believed that the famous bridge across the Menai Straits in England, with a span of 570 feet, would forever constitute a world's wonder. However, only fifty years later, this length of span had been almost trebled by the Brooklyn Bridge; and the span of this bridge, in turn, has been more than doubled by the George Washington Bridge. Fifty years ago, the Brooklyn Bridge was by far the most outstanding engineering work of its kind, with its span of approximately 1500 feet. The George Washington Bridge has a span of 3500 feet and a traffic capacity at least four times greater.—*O. H. Ammann in Technology Review*



The Largest Shop Electric Welding Job Ever Undertaken at the East Pittsburgh Works of the Westinghouse Electric & Mfg. Co. Reinforcing Ribs are being Welded on the Huge Intake Gates of Boulder Dam. The Section Shown is One of Six that Make up the 32-foot Diameter, 110-ton, Cylindrical Gate. Eight of These Gates Control the Flow of Water from the Dam Reservoir to Water-wheel Generators that Produce 1,000,000 Horsepower

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At the World's Fair in Chicago, the Westinghouse Electric & Mfg. Co. has on exhibition a 300-horsepower synchronous motor running at 514 revolutions per minute, which can be stopped almost instantly. In fact, it travels only four revolutions from full speed to a standstill. When the stop-button is pressed, a double-throw contactor disconnects the motor from the alternating-current line and connects a dynamic braking resistor across its terminals. The motor then acts as a generator, stopping almost instantly—actually in less than a second's time.

EDITORIAL COMMENT

Labor's Obligation in the Industrial Recovery Program

The prevalence of strikes in many industries is a serious obstruction to the success of the President's industrial recovery program. It is not enough that the Government and employers bend every effort toward increasing employment—*labor must do its part*. Wherever there is a strike, labor is failing to do its part.

The responsibility for industrial recovery rests on all alike, labor as well as employers. The protection of the Government has been invoked by labor and has been freely given. Unfair practices on the part of employers have been outlawed; the strike as a weapon for settling industrial disputes, should be outlawed also.

It is a serious omission in the National Recovery Act that no provision is made for settling differences between employers and employes without recourse to strikes. The Act should have provided for compulsory arbitration by a board composed of representatives of labor, of the employer, and of the public. Such a board, representing all the interests involved, could be depended upon to arrive at a fairer settlement than can be achieved by other means. It would prevent industrial strife at the very time when such strife is likely to do the greatest amount of harm. The mediation boards organized under the NRA serve a useful purpose, but they have no authority to prevent strikes—they can only act as mediators. The success of the national recovery program requires that the full responsibility of labor be recognized, both by the Government and by the labor leaders themselves; and it is not too late for the Administration to take steps to deal vigorously with all who obstruct its efforts.

After Each Depression the Problem of Training Workers Arises Anew

When the machinery industries again find themselves in a position to run full time and employ a complete labor force, it is likely that they will be confronted with the problem of a scarcity of skilled labor. Many skilled toolmakers and machinists, during the present inactivity in the machinery field, have found occupations in entirely different lines of work, and some of these will never return to machine shop work. As a result, the industry will once more find it necessary to give attention to the training of skilled workers.

It is unfortunate that these recurring depressions force men who have spent years in acquiring skill in their chosen trade to seek work outside of the industry in which they have been trained. If their new work proves congenial to them, they are lost to the industry and their training and skill have gone for naught.

There is only one way in which this difficulty could be overcome, and that is by minimizing as far as possible the severity of recurring depressions. Possibly the present efforts toward industrial control by industry itself will aid in this direction. It is a problem that cannot be solved by theorizing; it must be gradually worked out through patient experimentation. Most mechanical problems have to be worked out in that way; it is unreasonable to expect that the economical problems confronting us can be solved in any other way.

Incomplete Addresses Delay Mail and Cause Unnecessary Confusion

The delivery of mail is often delayed and unnecessary work is imposed upon the post office because of the fact that many firms leave off the street address of their office or works on letterheads, circulars, and catalogues. The difficulty is aggravated when the firm is located in one of our larger cities. It would greatly facilitate the transaction of business in general if all firms, even the largest, would make it a rule to put their street address on their printed matter.

In this connection, it may also be worthwhile mentioning that the custom of giving the name of a building instead of the street number is very confusing. This custom is used to a greater extent in some cities than in others and ought to be discouraged. Those doing business with a firm find it much more difficult to locate the office when it is designated by the name of a building than when the number and street are given.

The address should also be *prominently* displayed on printed matter. It is the first link in establishing contact with a new customer.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Inexpensive Intermittent Mechanism

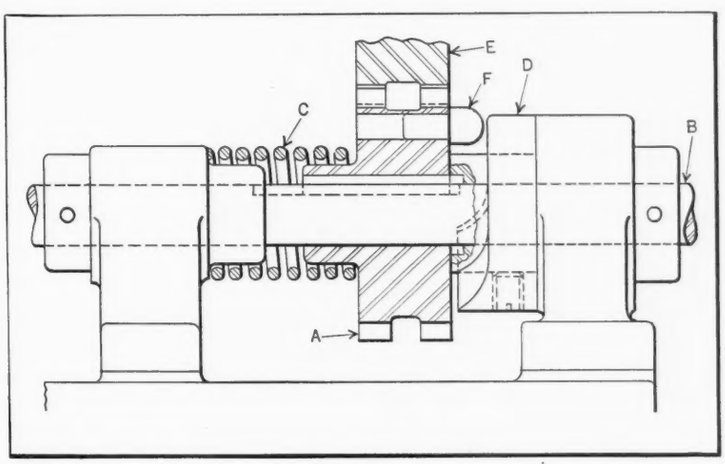
By J. E. FENNO

The demand for economy in the design of an automatic shell-marking machine led to the development of the simple intermittent gear mechanism shown in the illustration. The intermittent movement is obtained by means of a stationary cam which imparts an axial movement to the driving gear. In this way, the driving gear is disengaged from the driven gear at the required intervals.

The driving gear *A* is mounted on the driving shaft *B*, and meshes intermittently with the driven gear *E*. Gear *A* is a sliding fit on the shaft and is normally held against the end of the right-hand bearing extension by the coil spring *C*. The cam *D* is a slip fit on this extension, but after the proper adjustment is obtained, it is clamped to the extension by means of the set-screw indicated. A button *F* in gear *A* serves as a follower for the cam.

In the position shown, both gears are in mesh and the driven gear is rotating. However, as button *F* comes in contact with the rise on the cam, the cam will gradually force the button, with the driving gear, toward the left. The axial movement of this gear continues until it is disengaged from gear *E*, which now begins to dwell. At this time, button *F* has reached the top of the cam rise. In this way, gear *A* is held out of engagement with gear *E* which continues to dwell until button *F* comes to the end of the cam rise. At this time, both button *F* and gear *A* commence to move toward the right under the action of spring *C*, thus re-engaging the gears.

The timing of this device can be varied by clamping the cam in different positions on the bearing extension; or if it is desired to vary the dwelling period, interchangeable cams may be provided. It will be noted that both gears are of the double type. With this arrangement, a shorter axial movement is required to disengage the gears and a smoother cam action is obtained because of the shorter throw.



Mechanism in which the Gears are Disengaged Intermittently by a Cam which Imparts an Axial Movement to the Driving Gear

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Cork Disk Feeding Mechanism

By JOSEPH WAITKUS

The device shown in Fig. 1 is used in conjunction with the cap-feeding mechanism described in March MACHINERY, page 458. As the caps are fed down the line the device places a cork disk in each cap, after which the caps continue on their way to other stations. The outstanding feature of the device is that it will not feed a cork disk *R* from the magazine *Q* unless there is a cap ready to receive it. This is quite important, because it frequently happens that the flow of caps is interrupted. If the device continued to feed the cork disks, they would be wasted and in all probability, the mechanism would jam.

The device is quite simple in operation and must be made very strong and rigid to stand up under the high feeding speed employed. It is synchronized with the cap-feeding mechanism, so that there is no chance for a misstep in production. The cork disks *R* are stacked in the vertical magazine or tube *Q*, which is kept in continuous agitation so that the disks assume a horizontal position, the upper ones falling down when those at the bottom are removed. A feeding finger *M*, slightly larger in width than the diameter of the cork disk, passes back and forth under the stack of disks, pushing them, one by one, under the plunger *P*. The plunger then forces the cork disk into the cavity provided for it in the cap. An anvil *S* is provided under the caps to take the pressure of the plunger.

The finger *M* slides in a groove provided for it between *D* and *T*. A hinged latch, consisting of parts *K* and *L* and the latch part *B*, is fastened to the feeding finger permanently. Below the feeding finger is the driving slide *F*, which functions in a groove between *T* and *E*. The driving slide reciprocates continuously under the action of the rocker arm *H* through the pin connection *G*. A groove cut in the top of the driving slide corresponds in shape to the projection *C* on latch *B*. When projection *C* rests in the groove on the top of the driving slide, the feeding finger *M* is reciprocated under the cork disk stack.

The mechanism is synchronized, so that a cork disk is in place ready to be forced down by the plunger just at the time when the cap begins to move from its place directly ahead of the cork disk feeding mechanism. A feeler bar *N* is placed at this point ahead of the cork disk feeding mechanism, and by its vertical motion, controls the feeding of the cork disks. The feeler bar is guided in a slot cut in the cap guide bar, and the opposite end rests in a slot in the end of the lever *A*, where it is retained in place by a pin *O*. Lever *A*, in turn, is pivoted on a screw *V*, and is balanced about its pivot point so that the weight will be slightly greater at the end where the feeler bar is located. This insures the proper contact between the caps and the feeler bar.

The opposite end of lever *A* rests on the horizontal projection *W* on latch *B* and on the tapered button *J*. The tapered button has a smooth vertical motion under the action of the light spring *U* in the well provided for it in *D*.

The operation of this device will be clearer by referring to the three views in Fig. 2, which show lever *A* in three different positions. The upper view shows the lever in the position assumed when a cap is under the feeler bar. The projection *C* on the latch is located in the slot on the driving slide *F*.

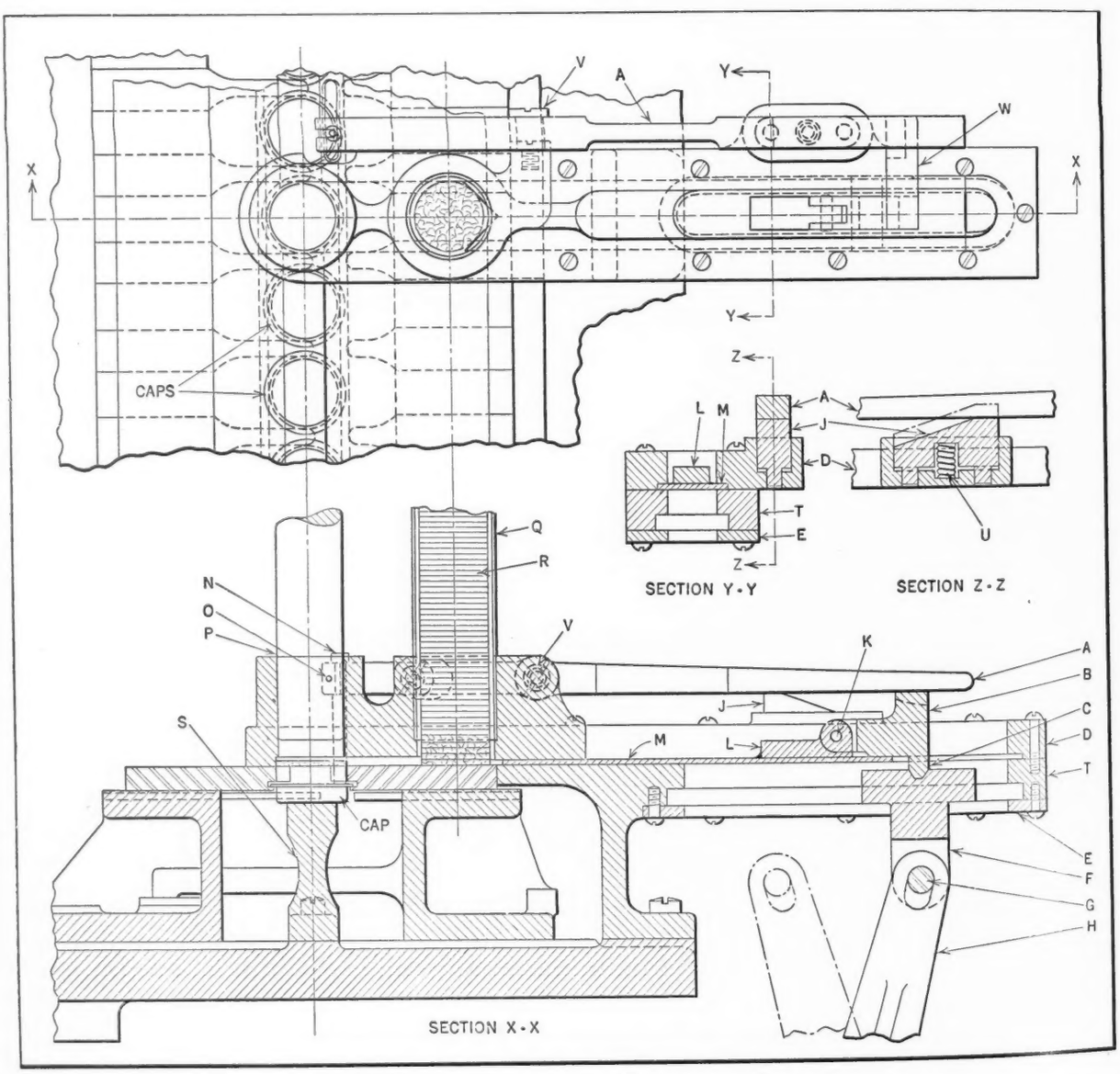


Fig. 1. Mechanism for Inserting Cork Disks in Metal Caps

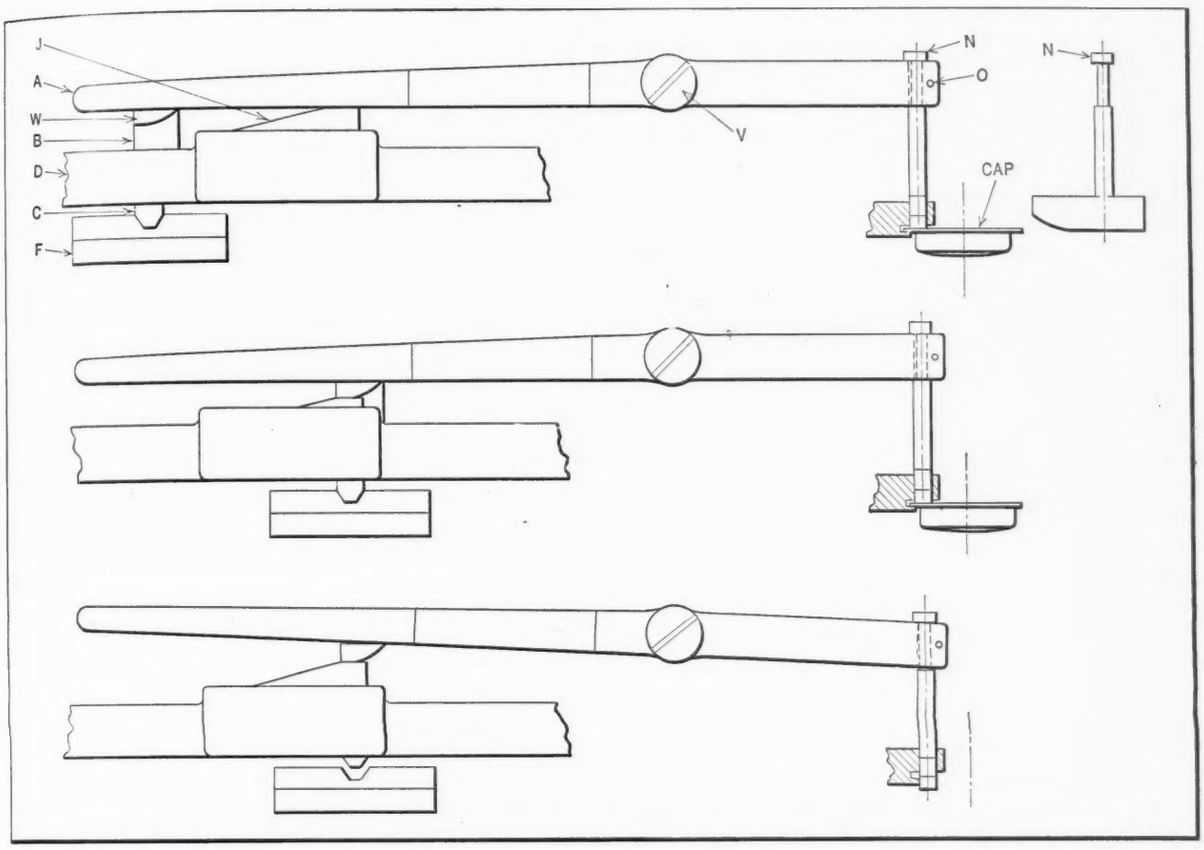


Fig. 2. Diagrams Illustrating Operation of Device that Stops Feed of Disks when Feed of Caps to Assembling Position is Interrupted

At the same time, the tapered button *J* is in contact with the lever. The central view shows the position of the parts when the feeding finger has pushed a cork disk into place under plunger *P*. Lever *A* is in the same position as in the upper view, which indicates that another cap is under the feeler bar. The projection *W* on latch *B* has depressed the tapered button, so that the projection *C* engages the driving slide *F*. When there is no cap under the feeler bar, the parts assume the positions shown in the lower view. In this case, lever *A* has been raised from the tapered button so that as the projection *W* rides up the tapered surface it lifts projection *C* out of the slot in the driving slide and thereby stops the movement of the feeding finger *M*, Fig. 1.

* * *

Protection Against Skin Infection from Oils and Lubricants

After many years of research, the Milburn Co., Detroit, Mich., has developed a product in the form of protective skin creams, intended to prevent skin infection from cooling lubricants, plating compounds, oil emulsions, and other sources of infection in industrial plants. Three types of these protective skin creams are available. They are applied at the plant before starting work and are known, respectively, as Ply No. 1, No. 2, and No. 3.

Ply No. 1 is a protective agent only soluble in water, and is used for preventing materials such as lacquer, paint, varnish, tar, asphalt, adhesive compounds, etc., from clinging to the pores of the skin, which would ordinarily necessitate the use of gasoline, thinner, or harmful and expensive abrasives for removal.

Ply No. 2 prevents or localizes infections resulting from cutting-oil emulsion, where such infections occur through the hair follicules or through mechanical injuries. This product is also water-soluble and should not be used where the compounds contain a large percentage of water. Both Nos. 1 and 2 creams rub into the skin dry. The skin is not left oily or slippery, and tools can be held firmly in the hands.

The cream known as Ply No. 3 is not soluble in water or oil. It is applied in the same manner as the creams already mentioned, but leaves a slight oily effect on the skin when applied. It prevents acid burns and skin infections caused by plating compounds and oil emulsions, except strong caustic solutions.

When these protective creams are used, it is not necessary to use scrubbing brushes for removing the cream from the hands, regardless of how stained the hands may become from the day's work. This fact alone will commend these creams to the machine operator.

Do You Design or Just "Make" Your Welded Joints?

Correct Design of the Weld Itself is Essential for Economy, Strong Construction and Subsequent Operating Safety

By R. KRAUS, Welding Engineer
Wm. B. Scaife & Sons Co., Oakmont, Pa.

ENGINEERS interested in the possibilities of welding face quite a task in seeking basic information to be used as a guide in weld design. Books giving general information on welding are available and the published results of a great deal of research and descriptions of structures successfully built are invaluable. However, very little has been published that can be readily applied to the actual design of the weld itself. This essential phase of the process, which involves the selection of the right type and size of weld to resist satisfactorily the stresses imposed upon the joint, will be dealt with in this article. The permissible stresses recommended here are intended for weld metal deposited by means of the electric process.

Types of Welds Generally Used

Fillet and butt welds are used in the design of most joints. At *A*, *B*, and *C* in Fig. 1 are shown both forms. Two fillet welds are indicated at *A*. They are triangular in cross-section, the throat lying in a plane disposed approximately 45 degrees with respect to the surfaces joined. In the single-welded butt joint shown at *B*, the joint is formed by the fusion of two abutting plate ends with the filler metal added from one side of the joint. Although it is not indicated, the side to which the filler metal is added is then reinforced by additional metal. The double-welded butt joint at *C* is formed by the fusion of two abutting ends, the filler metal being added from both sides of the joint and reinforced (not shown) on both sides.

Eliminating Preparatory Fitting to Reduce Manufacturing Cost

Welding is primarily done to reduce manufacturing cost. Preparation prior to welding, consisting of cutting, beveling, and fitting of the parts, represents a large share of the final cost. In general, a fillet weld costs less and is most desirable, as it requires little preparation in the joint itself. The fitting of this joint is also much easier when a reasonable allowance is made for unavoidable variations in manufacturing.

Proper allowances should be made to support the weld. For example, at *E* is shown the foot of a pedestal. From 1/4 to 1/2 inch should be allowed from the edge, in addition to the space occupied by the weld, depending on the size of the structure; otherwise, time will be wasted in fitting. Insufficient allowance will also result in part or all of the fillet being made under size, because if it is attempted to make the fillet full size, the liquid metal will run over the edge, and after it solidifies it will present a poor appearance, as shown at *F*. At *D* is shown how a pad can be attached to the side of a bedplate with either a fillet or a bevel weld. Note that the beveling is done on the lighter member to obviate unnecessary handling of the heavier part.

Fitting of small parts adds a good deal to the cost of fabrication. The diagram at *J* shows how three small pads were replaced by one larger pad. This change facilitated the fitting and reduced the amount of welding.

Another instance of simplified practice in fitting occurs in the making of tanks or similar parts having a flange. No matter how carefully the parts are rolled, the top of the vessel will not be perfectly round. This is due to a slight difference in ductility in different parts of the plates, resulting in uneven stretching. With the weld design indicated at *G*, fitting is easy. The fillets between the two component parts can be made with no difficulty. However, if the design of weld indicated at *H* is used, difficulties will be experienced in welding, due to the unavoidable gaps between the two mating parts.

Inaccessible Welding Should be Avoided

Easy access for welding will help to keep the cost down and the welds will be more likely to be of better quality and capable of developing full strength. The frame at *K* can be readily welded, as the welds are accessible. If many of these frames are to be made and a jig is provided, the welding can be finished at one set-up. If the frame were fabricated as shown at *L*, the right-hand welds would be inaccessible. To make the lower welds, it would be necessary to turn the frame over and probably remove it from the jig.

It might be well to point out here how to recognize an inaccessible weld on a drawing. If the throat line is extended and bisects any adjacent part, it is evident that the electrode cannot be pointed correctly at the fillet. Pointing the electrode in any other way than in the direction of the throat line

does not permit the arc to be played equally on the vertical and horizontal surfaces between which the joint is made.

Another example of an inaccessible weld is that of a pipe connection to the inside of a tank. Occasionally, as in vacuum-tight work, a weld of this type is necessary. For example, at *M* the lower part of the weld cannot be made at all, while if the weld is made as shown at *N*, it is possible to weld around the entire periphery of the pipe.

How Subsequent Pressure Tests Influence the Design of the Weld

Subsequent pressure tests influence weld design. Assuming that the vessel indicated at *O* has to be oil-tight, any leaks in the outside weld can be observed easily during the test. If an inside weld is necessary for strength, it should be intermittent. This is important, because if both welds are continuous, it may take longer for the testing oil to seep through to the outer weld than the time allowed for the test. Hence, defects in the outer weld will not be detected until the vessel is put into use.

A design is unsatisfactory if it cannot be conveniently observed during the test of the weld, which is the case with the tank shown at *P*. A special fixture is necessary for mounting this tank and the observer must of necessity be under the tank. In addition, if such a tank leaks after being installed, difficulties will be experienced in making repairs.

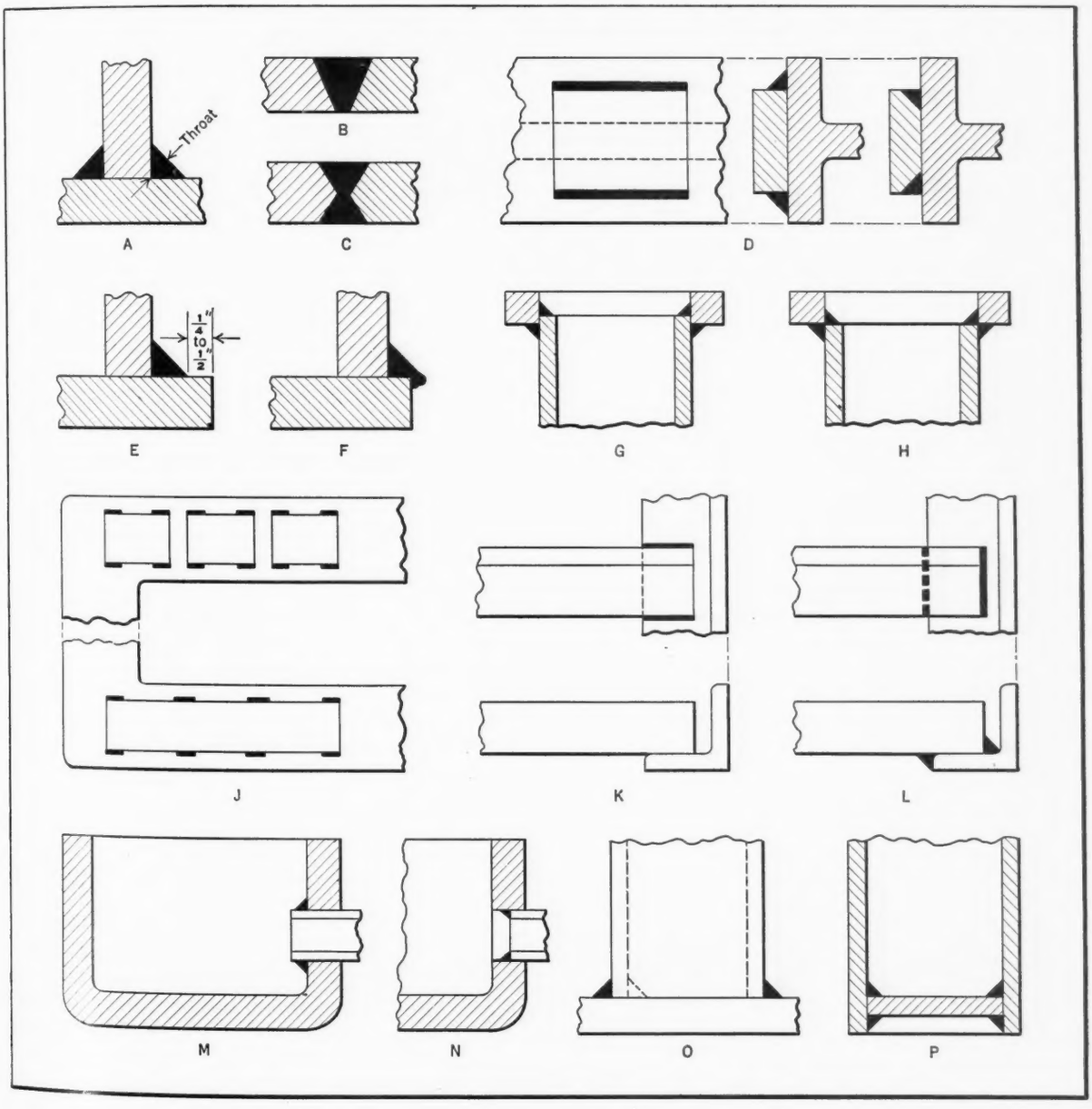


Fig. 1. Different Applications of Welded Joints, Some of which are Open to Criticism, as Explained in the Text

Preparing the Joint for Butt-Welding

In selecting the form of the joint and the preparation required, the designer must keep clearly in mind the fact that the final cost depends on the amount of preparation and the quantity of filler metal necessary. Incidentally, contraction stresses and warping are proportional to the amount of filler metal used. The only reason parent material is removed prior to welding is to make the component parts accessible.

The type of joint is influenced by the thickness of the plate, the method of welding—if done manually or by automatics—and by the type of electrode that is used. Working with bare electrodes requires better access of the arc to the abutting edges of the plates. To be sure of fusion when using bare electrodes, it is necessary to point the arc approximately at right angles to the beveled side of one part and still have clearance between the electrode and the side of the other part, as shown diagrammatically at *F*, Fig. 2.

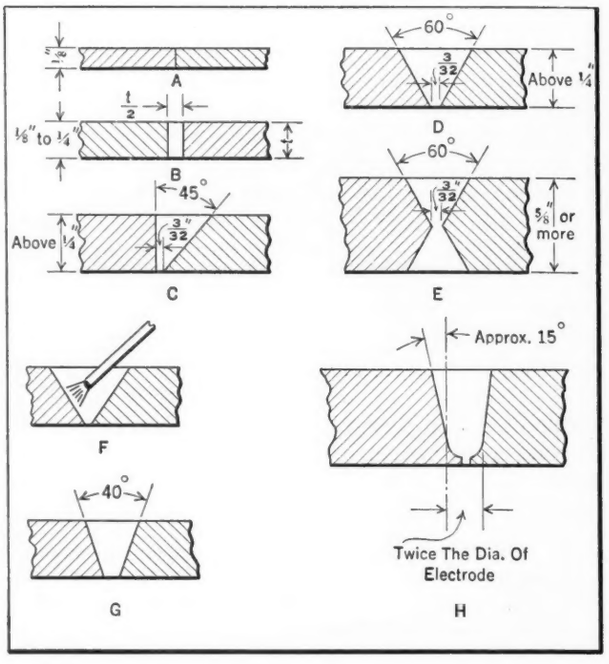


Fig. 2. Recommended Design of Various Butt Joints for Different Plate Thicknesses

The preparation of butt joints for various thicknesses of plates is shown in Fig. 2. Butt welds require no preparation when the component parts are less than 1/4 inch thick; and, as indicated at *A*, for welds up to 1/8 inch thick, the parts may be butted with no gap. In the latter case, the heat of the arc or torch penetrates the full thickness of the plate. Above 1/8 inch and up to 1/4 inch, as shown at *B*, a gap should be provided between the component parts equal to about one-half the thickness of the plate. With plates greater than 1/4 inch thick, at least one of the plates should be beveled, as at *C*. However, if the full strength of the plates is to be developed, both plates should be beveled, as at *D*.

Plates 5/8 inch thick or more are generally prepared, as indicated at *E*, for a double-vee butt weld, if both sides are accessible for welding. The angles for beveling shown at *C*, *D*, and *E* are intended for manual arc welding with bare electrodes. For gas welding, the single bevel should be increased from 45 to 60 degrees, and for the single-vee and double-vee butt welds, the total angle should be increased to 90 degrees. This is necessary to permit the flame to reach the bottom of the vee.

A reduction in the amount of weld metal is possible in machine arc welding. Instead of the 60-degree bevel shown at *D*, a 40-degree vee bevel is sufficient, as indicated at *G*, because penetration at the bottom of the sharper angle is possible with the higher amperage which permits a short arc to be uniformly maintained with the automatic feed.

For 3/4-inch plates or heavier, an additional saving of weld metal is possible by using coated electrodes, because the direct pointing of the arc illustrated at *F* is not so essential as with bare rods. The heat of the shielded arc is more concentrated, thereby assuring better fusion. This permits the use of a joint like that indicated at *H*. The angle for beveling and the spacing of the parts is influenced by the diameter of the electrode, which, in turn, depends on the thickness of the plate and the quality of the work required. In present practice, the tendency is to use 1/4- and 5/16-inch electrodes for plates 3/4 inch or more thick.

Procedure in Making Fillet Welds

The fusion at the start of the weld is not always perfect for a distance of about 1/8 to 1/4 inch from the ends of the joint. Therefore, a minimum fillet length is recommended. One convenient rule is to make the length of the joint at least 3/4 or 1 inch, depending upon the skill of the operator. When welds are intermittently placed on both sides of a plate, they should be staggered and the distance between intermittent welds should be limited. Rules that have proved satisfactory in riveting can be applied here. In compression members, the spacing between the welds should not exceed sixteen times the thickness of the thinnest plate. For other cases, a distance of fifty times the thickness of the thinnest plate will prevent weaving of the material between the welds.

Calculating the Stress that a Butt-Welded Joint Must Resist

After the form of the joint has been decided upon, it is necessary to determine the size of the joint to resist the stresses imposed upon the joint while in use. Three types of stresses are generally considered—namely, tension (or compression), shear, and bending. The simplest case of tension is that of a butt weld, as indicated at *A* in Fig. 3. Here the stress $= \frac{P}{tl}$, P being the load in pounds

and l the length of the weld. No reinforcement is shown for this butt weld. However, the Boiler Code recommends a slight reinforcement—just sufficient to avoid a depression in the finished weld. The reinforcement does not enter into the calculation and can therefore be subsequently machined off. Incidentally, a heavy reinforcement on one side establishes an eccentric loading and tends to increase the stress on the unreinforced side, and hence is objectionable.

Determining the Stress that a Fillet Weld Must Stand

A more complicated case is the calculation of the stress affecting the fillet weld of a T-connection, such as that indicated at *B*. The weld joint is subjected at *a* to tension and at *b* to shear, while the minimum section, called the throat, is subjected to both stresses. Ordinarily, in order to analyze these stresses, it would be necessary to resolve them into component parts—normal and parallel to the throat section. Instead of doing this, however, it has been found more convenient to assume that the force P acts perpendicularly on the throat plane, irrespective of its actual direction, and to use arbitrarily the following simple equation for tension or shear:

$$\text{Stress} = s = \frac{P}{2tl}$$

Here, P represents the load in pounds, t the throat depth in inches, and l the length of the weld in inches. This simple equation has proved satisfactory, inasmuch as welds tested to destruction generally break through the throat section. Test data of many thousands of welds have further substantiated this fact.

With the joint shown at *C*, tests show better results for shear than with the joint indicated at *D*, because each lineal part of the weld takes an equal share of the load. In the weld at *D*, the loading is progressive, as in the case of rivets. However, the difference in the test figures for the two types of shear is not great enough to set up a different permissible stress for each type. When both transverse and longitudinal welds are used in the same joint, more of the load is taken by the transverse weld. In such a case, some designers allow a lower permissible stress.

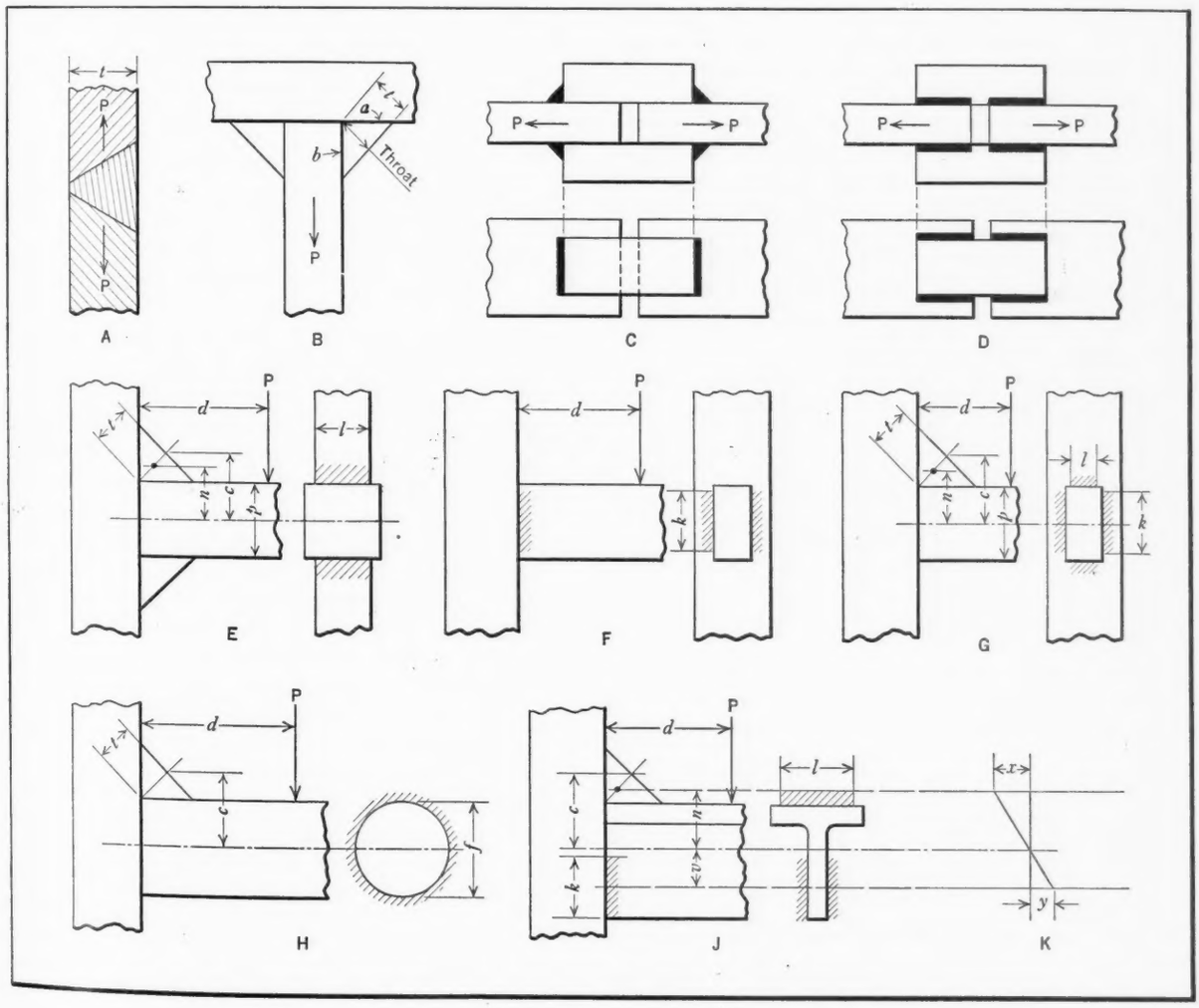


Fig. 3. Different Types of Welds, the Stress Formulas for which are Given in the Text

Formulas for the Bending Moment for Welds in Various Locations of the Beam Joint

The established formulas for bending apply directly to the calculation of bending stresses in butt welds. The equation for the bending moment of the weld at E can be written

$$M = Pd = 2l \times \frac{tn^2}{c} \times s$$

However,

$$n = \frac{p}{2} + \frac{1}{3}t$$

Hence,

$$M = Pd = \frac{lt}{c} \times (p + 0.67t)^2 \times s$$

When the welds are located as shown at F, the equation for the bending moment becomes:

$$M = Pd = 0.34k^2s$$

At G, both types of welds are used, in which case the formula becomes:

$$M = Pd = \frac{t}{c}\left[l\ (p + 0.67t)^2 + \frac{k^3}{6}\right]s$$

If round material or pipe is used, as at H, for the welded member subjected to bending, the equation will be:

$$M = Pd = \frac{\pi}{64c}\left[(f + 2t)^4 - f^4\right]s$$

For the T-section shown at J, it is necessary to determine the location of the common neutral axis of the welds. This can be done either graphically or by calculation. The graphic method will be found to be the quicker. The areas of the throat planes are plotted as shown at K, y representing the area of the transverse weld and x the area of the two longitudinal welds. The equation for the bending moment will then be:

$$M = Pd = \frac{t}{c}(ln^2 + \frac{k^3}{6} + 2kv^2)s$$

Table 1. Permissible Stresses for Fillet Welds

Throat Depth of Fillet, Inch	Ultimate Strength, Pounds per Square Inch		
	40,000	45,000	60,000
	Permissible Stress, Pounds per Inch of Length		
1/4	1770	2000	2650
3/8	2650	3000	4000
1/2	3540	4000	5300

After the permissible stresses are decided upon, the size and length of the weld can be readily determined. Weld metal deposited by the average qualified welder with bare rods has an ultimate strength ranging from 40,000 to 55,000 pounds per square inch and a ductility of 5 to 10 per cent in a 2-inch specimen. Coated rods of weld metal, however, will have an ultimate strength of from 60,000 to 75,000 pounds per square inch, and a ductility of at least 20 per cent in a 2-inch specimen.

The term "coated rod" is intended to include any type of rod with a covering that will produce a shielded arc—that is, one surrounded with an atmosphere for protecting the weld metal against oxidation. Many shops base their calculation on lower ultimate strengths, namely, from 40,000 to 60,000 pounds. In building construction, however, where bare rods are used, 45,000 pounds has been taken as standard. With suitable electrodes, proper parent material, and qualified welders, results can be anticipated within close limits; hence the quality of the weld does not depend upon the personal factor alone.

Table 2. Fillet Sizes for Different Plate Thicknesses

Plate Thickness, Inch	Fillet Size, Inch
1/8 to 3/16 (inclusive)	1/8 to 3/16
1/4 to 3/8 (inclusive)	1/4
Above 3/8 to 5/8 (inclusive)	3/8
Above 5/8	1/2

For convenience, Table 1 is shown giving the permissible stress per inch of length for the most common sizes of fillets. A safety factor of 4 is used, as is customary for static loads. These stresses can be reduced in proportion for other safety factors.

In this table it is assumed that the permissible stresses for tension, compression, and shear are the same. This will be found acceptable for the design of machine parts in general, although the Building Code permits somewhat higher figures for tension and compression. The table is limited to 1/2-inch fillets. Larger welds than 1/2 inch are, of course, used when concentrated stresses require it.

Avoiding Thick Welds to Reduce Manufacturing Costs

In general, it is more economical to use smaller welds and make them longer. The strength of a fillet increases with its length and size, while the volume of the weld metal increases with the square of its size. For example, assume that a safe load is 30,000 pounds for 10 inches of 3/8-inch fillet or 7 1/2 inches of 1/2-inch fillet. The volume of the 7 1/2 inches of 1/2-inch fillet weld will exceed that of the 10 inches of 3/8-inch fillet by 33 per cent, yet the strength remains the same.

There is a practical limit to the sizes of the fillets used in the joints of component parts. For instance, a fillet that is too small, say a 1/4-inch fillet on 3/4-inch material, is not desirable, because its volume is insufficient and the fillet is likely to crack during cooling. That is, the heat absorbed by the component parts so far exceeds that in the fillet that the contraction of the former may set up undue stresses in the fillets during cooling which are often sufficient to cause rupture. The same judgment should be used in the choice of the fillet size as in the proportioning of machine parts.

Handling of large pieces frequently imposes greater localized stresses on the welds than the normal operation of the equipment. Hence, as a general guide, it is recommended that fillets should be no smaller than 3/8 inch in the fabrication of heavy parts, and 1/4 inch on lighter pieces that are welded in a shop producing heavy work. Another argument in favor of the larger fillets is that in hand-welding with 3/16- and 1/4-inch electrodes, it is difficult to make fillets smaller than 1/4 inch.

Table 2 can be used in the selection of suitable fillets for joining plates of a given thickness, the thinnest plate in the assembly governing the size of the fillet.

In order that the manufacturing cost will not be increased unnecessarily, the amount of welding metal should be held to the minimum, consistent with the required strength. Although the cost of welding rod per pound is relatively small, the cost of depositing this metal is an essential item and ranges from $1 to $2 a pound. Incidentally, for lighter work, the danger of warping is increased when large amounts of metal are deposited.

In Figs. 1 and 3, fillet welds have been indicated as small "blacked in" triangles in end views, and as heavy lines in other views. This method is very convenient for showing fillet welds and is suitable for most machine details. Intermittent welds can be readily dimensioned. In this way continuous welds need be indicated only in the end view, where they appear as triangles, with a note "continuous" or "all around."

An Important Clause in Fair Practice Codes

By A. G. ALEXANDER, Manager, Frank Rose Mfg. Co., Hastings, Neb.

THERE is one unfair practice in industry that has caused much price cutting and even bankruptcy—a practice that has been ignored in all codes that the writer has had an opportunity to read. This practice presents a problem to the manufacturing plant without means for producing its own base materials, such as bar stock, sheets, shapes, tubing, castings, forgings, etc. There are many plants that, through years of hard manufacturing and sales effort, have built up a public demand for a product and that find, after this demand has been created, that the powerful manufacturer of the base materials used, seeing the possibility for profits through subsidiary companies or manufacturing departments, starts to produce the same articles or equipment. The raw materials used in the production are sold to the subsidiary company or manufacturing department on a cost-plus-handling-charge basis, eliminating all sales expense.

This puts the manufacturer who is paying the market price at a decided disadvantage, because these subsidiary companies are able to sell profitably at lower prices, due to their lower material costs.

Manufacturers without facilities to produce raw materials do not question the right of the large raw-material producer to engage in the manufacture of any commodity he pleases; but since these companies continuously talk about others selling below cost, they certainly should observe the rules of fair price competition when they are competing with their own customers.

This unfair practice could be taken care of by a fair practice clause in every code, which would provide that in establishing sales prices, all raw materials must be charged at cost on a basis of current market quotations, including delivery charges, irrespective of whether the materials are obtained from a subsidiary organization with interlocking ownership at lower cost or are bought in the open market.

Such a fair practice clause would do much to maintain reasonable prices. If the large corporations who manufacture in competition with their customers of materials will come into the market on this price basis, they will have the advantage of making larger profits than the small manufacturer who pays the market price for materials. To this they certainly should not object.

As an example, let me refer to our own company. Through years of effort, we have developed one of the largest businesses in the country for floor pumps for bicycle and automobile tire inflation. We have purchased steel tubing in carload quantities. In late years, subsidiary companies and manufacturing departments of one or two steel-tubing mills have entered this field and made list prices that it is impossible for us to meet, because the market price of steel tubing makes the pump barrel the major factor in the manufacturing cost.

There are a great number of companies in varied lines of manufacture who have similar problems. Frequently, these smaller companies have been able to compete with this material price handicap simply because they were located in communities having a lower hourly wage rate or a longer working day. This advantage the codes are now taking away from them, without giving them any equalizing factor in return.

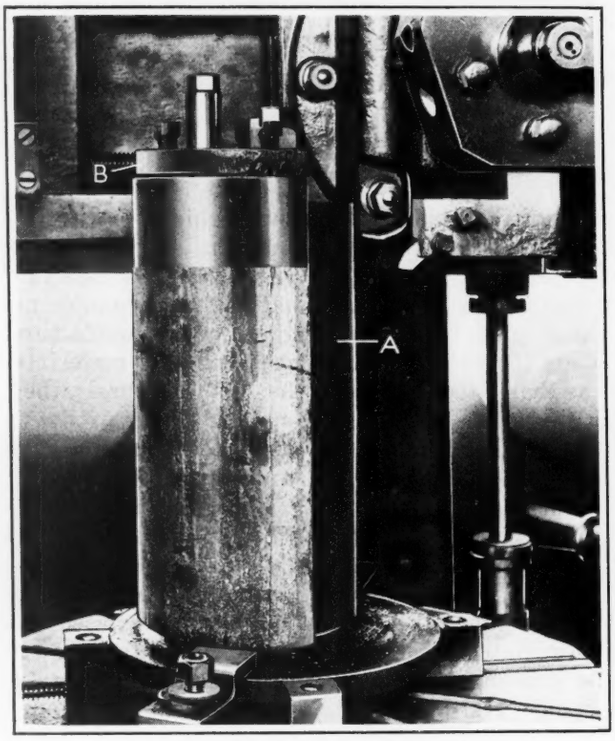
Uniform accounting systems will not solve the problem of price competition unless there is a uniform price in base materials. It is immaterial how wide a margin of profit is made by a competitor, but it is essential that he arrive at list prices and discounts on the same basis as those who have to buy their raw materials in the open market. That is the outstanding basic principle of fair practice in any line of manufacturing.

Turning Driving-Box Brasses with Tungsten-Carbide Cutters

By CHARLES O. HERB

At the Stratford, Ontario, shops of the Canadian National Railways, driving-box brasses are turned on a vertical boring and turning mill. This type of machine has been adopted for the operation because, through the use of simple fixtures, the driving-box brasses can be easily set up and the floor-to-floor time is considerably reduced.

Another feature of this operation is the use of a tungsten-carbide cutter. Both roughing and finishing cuts are taken with the same tool, the total stock removed being about 1/8 inch all around, or 1/4 inch on the diameter. The average production on this job, between regrindings of the tool, even with the "jump" cut, is seventy-five brasses. When high-speed steel cutters were used in this operation, it was generally necessary to use two cutters on one brass. The brasses revolve approximately seventy-five times a minute, which means a surface speed of about 250 feet per minute. The feeding rate is 1/24 inch per revolution. The brasses range from 12 to 21 inches in length.



In Turning Driving-box Brasses on a Boring Mill with Tungsten-carbide Cutters, an Average Production of Seventy-five Parts between Regrindings is Obtained

From the accompanying illustration it will be seen that the fixture for this operation consists simply of a hollow cylinder *A*, with a large circular flange at the bottom and a clamping plate *B* at the top. Three studs hold plate *B* to the cylindrical portion of the fixture, and the clamp is equipped with three set-screws for tightening it on the work. The fixture flange is centered by the four jaws of the table chuck, and is held to the table by means of two clamps.

Fixtures of this type have been made in four diameters and lengths to suit the various sizes of driving-box brasses. Each fixture will accommodate several sizes. The machine is equipped with a jib crane and air hoist for lifting the fixtures and work on and off the machine. Only a few minutes is required to set up the fixture, while the set-up time for the work is comparatively negligible.

Careful Handling of Drawings and Tracings

By A. J. DICKSON

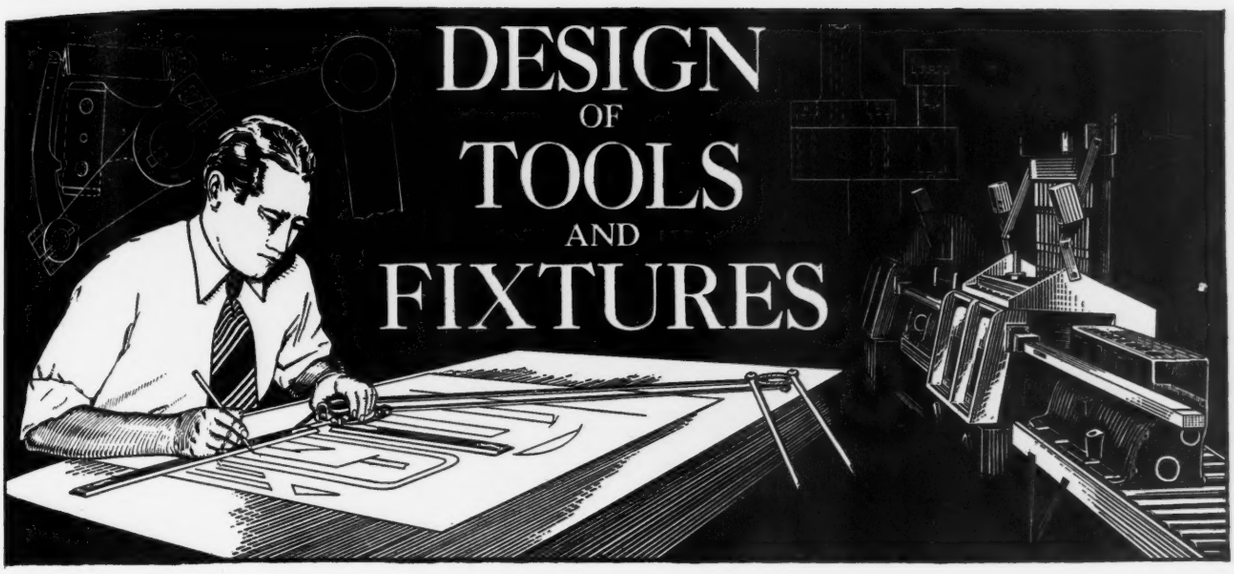
The writer has noted the great care taken in many plants to check drawings, in order to make sure that they are correct and to impress draftsmen and tracers with the need for care in drawing and lettering. In direct contrast to this care in preparing drawings is the carelessness with which drawings and tracings are often handled after they have left the draftsmen's hands. That moment seems to be the signal for a "do as you like with it" attitude toward drawings.

It would be well for the manager of every plant to ascertain if the blueprint boys or girls handle tracings with care. Are any of the envelopes, filing cabinets, etc., so overcrowded with drawings that it is not possible to file them without injury? Are new drawings permitted to become soiled by laying on the draftsman's reference table when not actually needed? Are the tracings in the blueprint room a safe distance from the water spray? Is the filing table used exclusively for drawings and tracings or are the tracings likely to be spotted by ink, mucilage, or other liquids?

An occasional checking up of these matters by the manager would result in the preservation of valuable drawings for longer periods. Much expense for retracing might be saved, and the efficiency of the drafting-room generally increased.

* * *

Of the efforts to secure national industrial recovery, none are more important than those that will aid the railroads in recovering normal purchasing power; because the railroads, after all, are the largest single-industry consumers of materials and labor in the country. Just take the matter of crossties; during the ten years ending December 31, 1932, the railroads spent $876,383,000 for crossties alone.

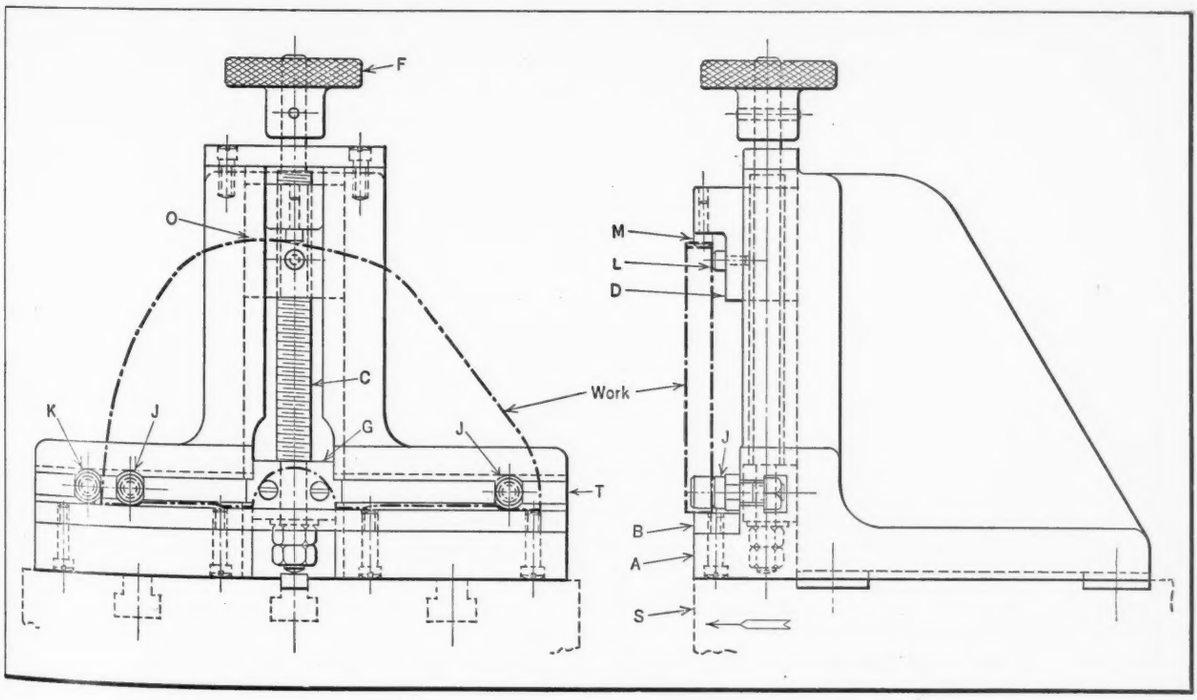


Grinding True Flat Surfaces on the Sides of Thin Cams

By H. KAFFINE, West Lawn, Pa.

Large numbers of cast-iron cams made in halves to facilitate mounting them on their shafts are used in the textile industry. These cams are ground on both sides, a magnetic chuck being used for this operation. When the cams come from the mold, they are often somewhat bent or distorted. The magnetic force of the chuck, however, flattens them out, but after the top surface is ground and the magnetic force released, they bend back again, so that they have a hollow instead of a flat surface. To avoid this concave or convex shape, the cam must be turned over on the chuck a number of times and reground in order to obtain a level surface.

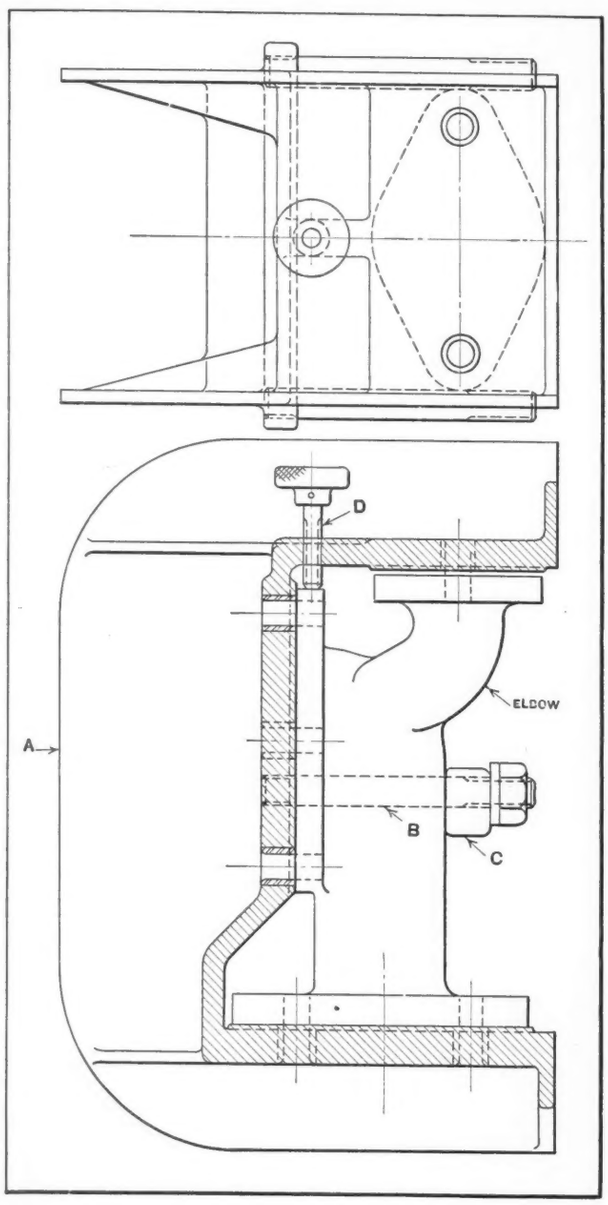
This costly practice was avoided by performing a rough-grinding operation previous to finish-grinding. The fixture shown in the accompanying illustration was used on a disk grinder having a swinging table for the rough-grinding operation. The cam to be ground rests on a hardened plate *B* and is located against the pins *J* and *L*. Pin *K* serves as an end-stop. By turning spindle *C* with handle *F*, the dovetail slide *D* is moved down on base *A*, causing the pin *M* to clamp the cam down on plate *B*. Care is taken to have end-stop *K* positioned properly, so that the point where pin *M*



Fixture Used on Disk Grinder for Removing High Spots on Sides of Thin Plate Cams

comes in contact with the cam is a little below the highest point *O* of the cam. This arrangement causes pin *M* to exert a wedging action on the cam, forcing it down and at the same time clamping it against end-stop *K*. The thrust of spindle *C* is taken up by block *G*, which is screwed against base *A* and has two tongues that fit the T-slot *T*.

The fixture rests on the movable slide *S* of the swinging table. By swinging the table parallel to the face of the grinding wheel and at the same time moving table *S* with a lever (not shown) in the direction indicated by the arrow, the outer cam surface is pressed against the wheel. This method of grinding removes the high spots of the cam quickly and rough-finishes the surface so that it can be clamped on the magnetic chuck without distortion for the finish-grinding operation. Stops *J* and *K* can be adjusted horizontally in the T-slot, and slide *D* with pins *L* and *M* can be raised or lowered by means of spindle *C* to accommodate cams of various shapes and sizes.



Rocker Jig of Economical Design with Three Sides Open to Facilitate Locating the Elbow to be Drilled

Rocker Jig for Drilling Elbow

By J. E. FENNO, Belleville, N. J.

The jig here illustrated is used for drilling the three flanges on a large elbow. This design was chosen rather than the box type because of its economy of construction; ease of operation, with less danger of injuring the operator's hands; and its accessibility, enabling the flanges to be easily located in the proper relation to the contour of the jig faces. Also, the rockers, which on the box type of jig are added weight, serve both as rockers and part of the frame for the type shown.

The elbow, which is drilled in a multiple-spindle drilling machine, is laid in the jig with the edges *A* of the latter on the table. The three flanges are then lined up with their corresponding jig faces, the thrust screw *D* is tightened, and the elbow is securely fastened with the open slotted strap *C* by tightening down on the collar nuts on the two studs *B*. This type of jig, with some modifications, has been used on other work of similar nature with success.

Fixture for Cutting Slots at Right Angles in One Operation

By C. W. HINMAN, Villa Park, Ill.

Grooves or slots located at right angles in small parts can be milled in one operation on a hand milling machine equipped as shown in the accompanying illustration. This particular equipment is used in milling four slots in the hard rubber part *W*, but the operating principle can be applied to equipment for machining a variety of small parts. The part *W* is a key button for telephone central offices, and is made in large quantities. The blank keys are turned to size on an automatic screw machine, after which the four slots are cut on the end.

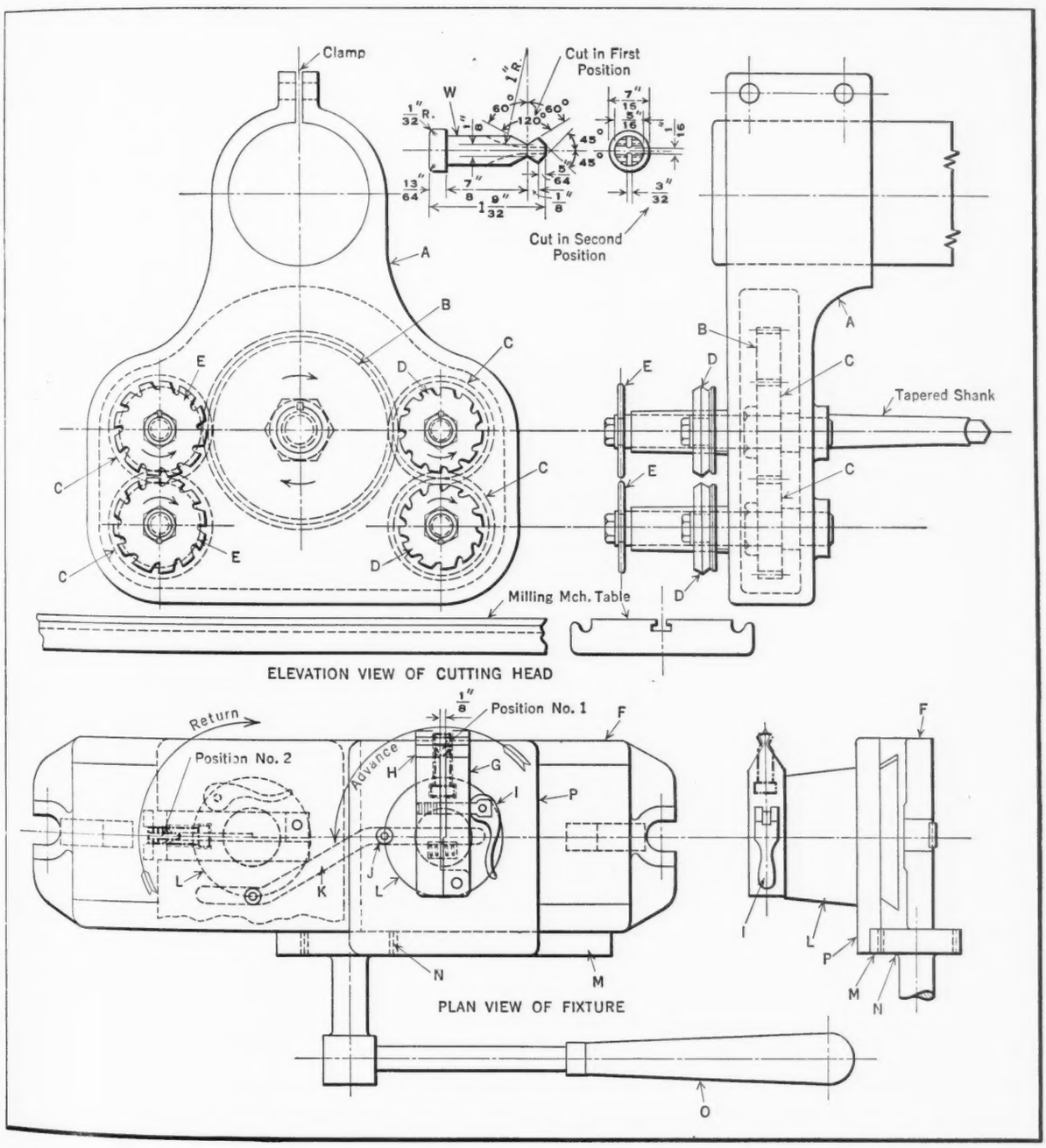
Referring to the plan view of the fixture, the turned piece to be slotted is clamped between the jaws *H* and *G* by clamp *I*, the carriage *P* being at the right-hand end of the dovetail slot in the base *F*. The work is now in position No. 1, indicated by the heavy dot-and-dash lines. The carriage *P* is next fed to the left by means of handle *O*, which transmits the feeding movement through the rack *M* and pinion *N*. As the carriage moves to the left, it carries the work past the cutters *D* shown in the elevation view of the cutting head.

Cutters *D* mill the 120-degree crosswise slots on opposite sides of the key. This completes the work

performed with the turret *L* in position No. 1. Continued movement of the carriage to the left causes turret *L* to index counter-clockwise through an angle of 90 degrees, bringing the work into the second position. The piece is now in front of cutters *E* in position No. 2, ready for milling the two 3/32-inch lengthwise slots cut on opposite sides of the work. The indexing movement is accomplished by means of a roller *J* which engages the cam-slot *K*. Roller *J* is mounted on a circular plate attached to the under side of the turret. The feeding movement is continued to the left until the lengthwise slots are finished.

It will be noted that the cam-slot *K* is straight at both ends. This provides for the straight cuts required in milling the four slots. Reversing the movement of handle *O* causes the carriage to return to the starting position ready for reloading. When the clamping jaws are opened, the finished work is ejected by a blast of air from an air jet (not shown).

The cutting head consists of the cast-iron housing *A* and the train of gears *B* and *C* which drive the formed cutters *D* and *E*. The cutters are mounted in holders that can be adjusted to compensate for grinding. The gears are enclosed in the housing and packed in grease. Annular, double-row type ball bearings are used throughout. The



Indexing-turret Fixture and Milling Cutter-head Used in Cutting Slots at Right Angles in Hard Rubber Part W

driving gear *B* is made of Formica and revolves clockwise. It is driven by the attached tapered shank which engages the spindle of the milling machine. The cutting head is held rigidly in position on the overhanging arm of the machine.

Lathe Attachment for Cutting Helical Oil-Grooves

By JAMES J. BAULE, Lynn, Mass.

Difficulty is sometimes experienced in cutting endless helical oil-grooves on work held in a lathe, especially when the bore is of considerable length. For such work, the arrangement shown in the accompanying illustration has been found satisfactory. It can be used for cutting both internal and external helical grooves.

A piece of 3/8-inch flat stock of sufficient length and width to make a cylindrical cam *C* is planed to the shape shown in the lower view. The height *T* is made equal to the axial length of the groove to be machined. The formed flat piece is bent into cylindrical shape and butt-welded. Three or four fastening lugs *F*, depending on the number of T-slots in the chuck, are welded to the cam so that it can be bolted to the chuck, as shown in the upper view.

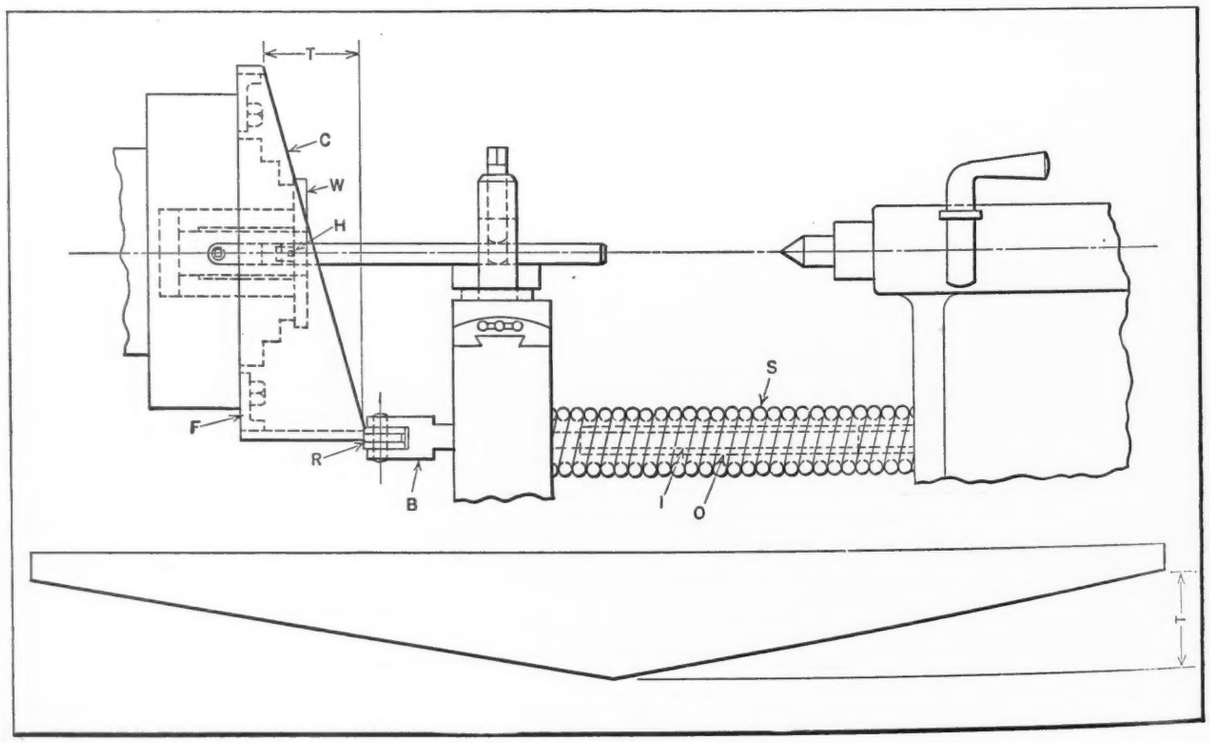
A grooved roller *R* is mounted in a carrier *B*, which, in turn, is secured to the carriage, so that, after the cam is trued up, rim *C* will run in the groove in the roller. Opposite carrier *B* is a compression spring *S*, which exerts pressure on the carriage and thus keeps roller *R* in contact with the cam rim. The spring is prevented from buckling by the telescoping tube *O* and pin *I*.

The work *W* is adjusted and held between the jaws of the chuck so that the tool *H*, shown in its outermost position, is opposite the outer loop of the groove to be cut. If difficulty is experienced in adjusting and centering the work, the compound rest can be turned lengthwise to facilitate moving the tool in and out. When two intersecting loops or grooves are desired, the jaws are loosened and the work revolved into position for cutting the second groove after the first one has been cut.

* * *

World's Largest Hydro-Electric Generators

The hydro-electric generators for the Boulder Dam development will be the largest in the world, according to information obtained from the General Electric Co., which company has been awarded the contract for building the first two units. These generators are rated at 82,500 kilovolt-amperes. Other large hydro-electric generators have been built for the Soviet Republic (77,500 K.V.A.) and Niagara Falls (65,000 K.V.A.). Four of these generators will be installed for opening the power station to be leased and operated by the City of Los Angeles. The ultimate plans call for fifteen such units. Each will have an over-all diameter of 40 feet and a height of 32 feet above the floor level. The units weigh more than a thousand tons each.



Lathe Equipped for Cutting Helical Oil-grooves

A New Idea in Balancing Small Parts

Vibrations Caused by Unbalance in the Work are Used to Generate Alternating Current in Proportion to the Unbalance

THE amount and angular location of dynamic unbalance in small high-speed rotors are quickly determined to a high degree of accuracy by means of a vibro-electric, self-indicating balancing machine recently developed by the Tinius Olsen Testing Machine Co., Philadelphia, Pa. Such parts as armature shafts for the fractional horsepower motors of electric refrigerators, vacuum cleaners, etc., can be handled at rates of from forty pieces an hour upward. The amount of unbalance can be determined to within a ten-thousandth of an ounce-inch, and the angle of unbalance to within plus or minus one degree.

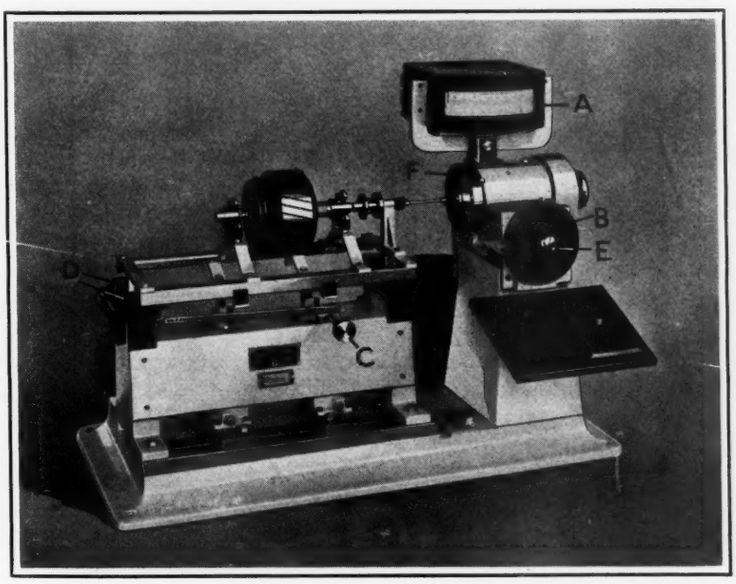
The principle on which this balancing machine operates is as follows: Any vibration set up as a result of unbalance in the work generates electric alternating current in proportion to the amount of unbalance. The electric current is generated as the two poles of a permanent magnet move in and out of two solenoids, the distance depending upon the amplitude of the vibration. The amount of unbalance in ounce-inches is read directly from the micro-ammeter *A*, which has been provided with a scale suitably calibrated. At the same time, the angular location of the unbalance is determined by revolving the graduated dial *B* until a maximum reading is obtained on the ammeter. The operation is so simple that a man can become skilled in running the machine within a few minutes.

Small roller bearings support each end of the work in a frame or cradle which is free to vibrate sidewise about either of two selective pivots. When the unbalance in the left-hand end of the work is to be determined, knob *C* is turned to lock the vibrating frame about a pivot directly below the rollers that support the right-hand end of the work. Conversely, when the unbalance in the right-hand end is to be determined, knob *C* is turned in the opposite direction to make the frame vibrate about a pivot located directly beneath the rollers that support the left-hand end of the work.

In the balancing operation, the work is driven from the right-hand end through a small adapter and a universal joint. Power for revolving the work is derived from a 1/8-horsepower motor running at a constant speed. On the drive-shaft in the right-hand housing is a bevel gear that drives a two-segment commutator at the same speed as the work being balanced. This commutator is equipped with a dual brush system by means of which the angle of unbalance is determined.

The work is rotated at a speed of 1500 revolutions per minute, it being preferable to determine the unbalance by running the part above the critical speed. The two poles of the permanent magnet already referred to are attached to the opposite sides of the left-hand end of the vibrating frame, and move back and forth horizontally within a solenoid attached to each side of the machine at *D*. The relative movements of the magnetic poles in the solenoids resulting from the vibration set up by the work govern the amount of the alternating current generated.

The alternating current thus generated is rectified into direct current by the commutator on the same shaft as dial *B*, so that sensitive readings of electric current can be easily obtained from ammeter *A*. In a balancing operation, dial *B* is turned until a maximum reading is obtained on the ammeter, indicating that the alternating current is being completely rectified. Then a small button in the center of knob *E* is depressed and dial *B* adjusted until the ammeter needle registers zero exactly. This gives still greater sensitivity in determining the complete rectification of alternating current into direct current. The button is then released. Ammeter *A* now shows the amount of unbalance in the part to within a ten-thousandth of an ounce-inch, and the angle of unbalance will be indicated by dial *B*



The Amount and Location of Unbalance in Small Rotors are Determined with this Machine through the Generation of Electric Current

to within limits of one degree, plus or minus.

When the angle of unbalance has been noted, the work is turned until the graduation on dial *F* that corresponds to the angle of unbalance as determined from dial *B*, has registered with a stationary pointer. Then the point of unbalance in the work will be in the horizontal plane at the front of the machine. Thus the operator can mark the work conveniently for balancing later by the removal of metal. After the amount and location of unbalance in one end of the work have been determined, the pivot of vibration is changed by turning knob *C*, as previously mentioned, and the opposite end of the work is checked in the same manner.

The maximum amount of unbalance indicated by ammeter *A* can be altered by changing the position of a plug that fits into any one of four holes in the panel board at the front of the machine.

This equipment is made in two sizes, one size being intended for handling work from 3/16 pound to 5 pounds, and the other for work from 1 1/2 to 12 pounds. The small machine will show a maximum unbalance of 1/4 ounce-inch, and the larger machine 1 ounce-inch.

New Thread Form for Taps

A Thread Form Called "Super-Crest," Producing Interchangeable U. S. Standard Threads, Prolongs the Useful Life of Taps

A NEW principle in thread construction is used in a tap now being introduced on the market by the J. M. Carpenter Tap & Die Co., Pawtucket. R. I., a subsidiary of Whitman & Barnes, Inc.

The new tap is known by the trade name "Super-Crest." The advantages claimed for this tap lie in a redesign of the United States or National form of thread, which is said to improve tool performance, provide a better fit, contribute greater strength in the assembly of tapped and threaded parts, and increase tap life considerably beyond the average heretofore expected, while, at the same time, permitting complete interchangeability with the United States standard thread form. To give a clear idea of the significance and importance of this new thread form in relation to the manufacture of taps and other types of screw-thread cutting tools, it is essential that the circumstances leading to its development be explained.

It is obvious that the United States or National form of thread, as originated by Sellers, is primarily a design, and that its reproduction in interchangeable parts requires limits and tolerances to allow for unavoidable imperfections. It is also a generally known fact that taps and other tools of this type are subject to excessive wear at vital points most essential to the maintenance of size, this wear being entirely out of proportion to the normal wear of other parts of the thread. This is particularly true in reference to taps, excessive wear being common at the crest of the thread, resulting in premature destruction of the thread form. This destruction of the thread form causes a fillet or "radius" to be formed at the bottom of the tapped thread which the thread gage cannot pass. The tap is then called "under size" and must be discarded. Fig. 1 shows an exaggerated example of this condition.

To overcome the difficulties caused by the condition described in the preceding paragraph, a redesign of the United States or National form of thread has long been contemplated, but efforts in this direction have so far proved impracticable because of either seriously affecting or entirely preventing interchangeability with the conventional United States thread form. Consequently, the tendency during recent years has been to attempt to correct the trouble through other means,

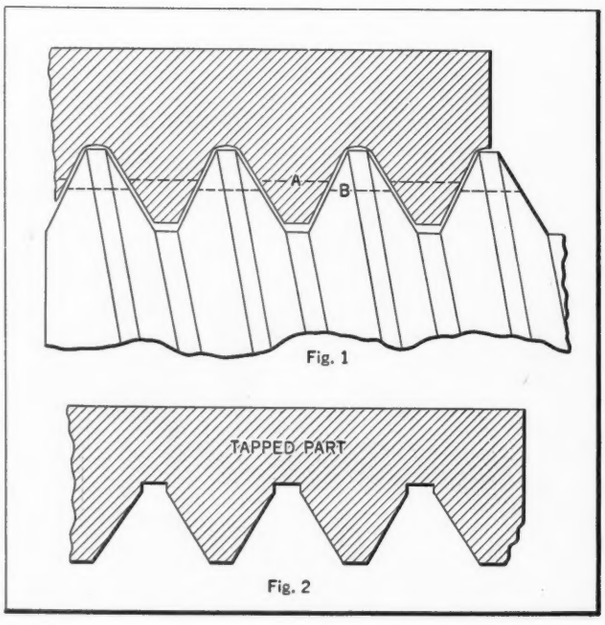


Fig. 1. Illustration Showing, in Exaggerated Form, Thread Cut by a Worn Tap. Line A is the Basic Pitch Line of the Tapped Hole. Line B Shows the Basic Pitch Line of the Largest Gage that will Pass through the Tapped Hole. Note that There is No Contact on the Sides of the Threads. Fig. 2. Thread Cut by a Super-Crest Tap

such as the readjustment of tolerances and the development of better materials and improved manufacturing methods. Activities along these lines have been useful, but have not eliminated the real cause of the trouble.

Engineers of the J. M. Carpenter Tap & Die Co. have long been engaged in seeking a permanent solution of the problem. Through observation, they determined that from 50 to 70 per cent of the taps discarded as under size had merely lost their true form or contour at the crest of the thread, and that the reduction of other dimensions due to tool wear was usually negligible. It was further found that, although the degree of reduction or change in contour at the crest of the thread varies widely according to the pitch of the thread and the class of fit, taps discarded as under size generally show a reduction of from 2 to 5 per cent of the single depth of the thread, whereas the reduction of the pitch diameter in the majority of instances is barely perceptible.

Of additional importance was the discovery that through a reduction of 10 per cent in the outside diameter of the basic or "Go" gage, the majority of the holes tapped with tools discarded as under size passed the gage, thereby indicating conclusively that the tolerances on other dimensions of the thread had not been exceeded. When tapped holes were checked with a gage thus reduced in outside diameter, from 10 to 50 per cent was added to the life of the tap.

In some instances, it was found that holes tapped with these rejected or under-size taps, although not admitting a "Go" gage with full depth of thread, would snugly pass a "Not Go" gage which had previously been reduced in outside diameter. This demonstrated that if it had not been for crest interference at the start, the tap would have been rejected as over size, the gage fit being made through contact at the crest and not at the load-carrying angle of the thread.

It is readily apparent that to have recommended a reduction in the outside diameters of all plug gages would have been impractical, and since a radical redesign of the United States form of thread appeared equally impractical, there was but one other course to pursue—that of changing the contour of the thread at its crest.

Such a changed thread form has been patented by Ralph E. Flanders, president of the Jones & Lamson Machine Co., and a former member of the National Screw Thread Commission, who had also

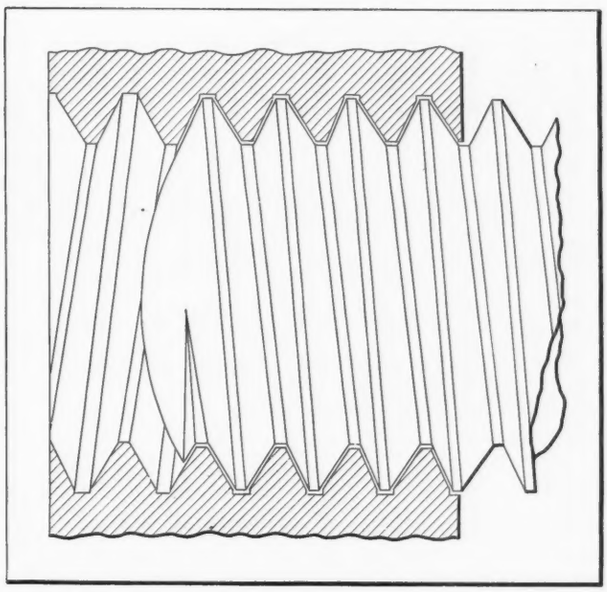


Fig. 3. Illustration Showing How a Screw with the United States Standard Form of Thread Fits into a Hole Tapped with a Super-Crest Thread Tap

been working on this problem. This thread form is now being introduced by the J. M. Carpenter Tap & Die Co., as mentioned, under the trade name "Super-Crest." The Carpenter company has acquired exclusive rights to manufacture and sell solid taps and prong dies under the Flanders patent, the Jones & Lamson Machine Co. retaining the rights to use it in connection with chasers for die-heads and collapsible taps.

Fig. 2 shows that the Super-Crest thread provides full depth of thread. All dimensions are exactly the same as for the United States form, with the exception that the flat at the crest of the thread is designed as shown. The width of this flat is governed by the pitch of the thread, but at no time exceeds 10 per cent of the depth of the thread. This modification of the United States thread form allows crest clearance for gages with 100 per cent (or full) thread depth, and through such clearance insures maximum metal-to-metal contact without affecting or preventing interchangeability with the United States form (see Fig. 3).

The tap life is said to be prolonged by a substantial margin in practically every instance, because a more proportionate reduction in the various dimensions through tool wear is made possible. No perceptible increase in power has thus far been noticed in the operation of the Super-Crest tap, as compared with taps having the conventional thread form.

The Super-Crest tap can, of course, be produced to any degree of accuracy attainable in the manufacture of taps of conventional design. It is claimed that this thread form will eliminate the inherent weakness that has prevented a practical relationship of the tolerances of the several thread dimensions in the past. What is probably more important, the Super-Crest thread form definitely adds to the strength of the assembly by providing for the distribution of the load over the thread-wall area, and tends to provide greater security of assembly through maximum metal-to-metal contact when the proper limits have been established. The Super-Crest thread form is not limited to any specific type of work, but can be applied generally to all classes of internal screw-thread production in various branches of the mechanical industries.

MATERIALS OF INDUSTRY

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Heavy Monel Metal Shafts for the Madden Dam

Twelve shafts of Monel metal, each 6 inches in diameter by 18 feet long, have been supplied for use as stems on the sluice gates of the Madden Dam, Canal Zone. This service requires a corrosion-resistant metal having unusual stiffness and a high yield point, combined with toughness.

The average properties of the shafts were as follows: Breaking strength, 101,000 pounds per square inch; yield point, 76,000 pounds per square inch; elongation in 2 inches, 33 per cent; reduction in area, 60 per cent; modulus of elasticity, 26,000,000. The high yield point is particularly notable, considering that it was obtained by cold-working a bar of heavy section.

Malleable Iron with Increased Hardness and Strength

A wear-resistant malleable iron with improved physical properties, as compared with the regular commercial product, was described in a paper presented by Miss Rebecca Hall before the American Foundrymen's Association in Chicago. Chromium was added to this malleable iron to increase the hardness and strength, and silicon was added to counteract the inhibiting effect of chromium in the annealing process. The paper was of especial interest because of the contention frequently advanced that chromium has a detrimental effect on malleable iron.

Without the addition of a graphitizing element, such as nickel or silicon, chromium is very dangerous, said Miss Hall, in amounts over 0.07 per cent, but silicon will counteract the effect of chromium, since it increases the softness and favors formation of the temper carbon.

The chromium additions ranged from 0.22 to 1.15 per cent and silicon from 1.02 to 2.02 per cent in fourteen heats, concerning which physical data was given. The lowest tensile strength was 67,000 pounds per square inch, and the lowest elastic limit, 41,000 pounds per square inch. A maximum tensile strength of 80,500 pounds per square inch was obtained with a mixture having 0.56 per cent chromium and 1.39 per cent silicon. The Brinell reading was 201. Elongation decreased as the chromium content increased, from 12.5 to 2.5 per cent. There was an almost progressive increase in the Brinell hardness readings with increases in the chromium content, the readings ranging from 168 to 223.

It was pointed out that the tensile strength of chromium-silicon malleable iron is from 10,000 to 25,000 pounds per square inch more than that of ordinary malleable iron.

Stainless Steel Tanks in the Dairy Field

The Hershey Chocolate Corporation, Hershey, Pa., has tanks located in various rural towns to which neighboring farmers deliver their supply of milk each morning. Later in the day, trucks remove the milk from the tanks and take it to the chocolate plant.

These milk-station tanks were formerly made of copper and coated with block tin. It was decided, however, to replace them with tanks of 18-8 chrome-nickel stainless steel. The first stainless-steel tanks of 700 gallons capacity proved so satisfactory that a second series holding 1000 gallons has recently been ordered. The seams of these tanks are oxy-acetylene welded.

Pickling-Tank Bricks Laid with Molten "Mortar"

Acid-proof bricks made by the Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa., for such installations as acid pickling tanks can be laid with a molten joining material such as sulphur or a melting compound. The use of ordinary bricks for such a purpose requires spacers and paper strips and involves considerable extra labor. The new bricks have cavities into which the molten material is poured and there are holes properly spaced to facilitate the pouring. None of the joining material is exposed to the action of acid

when the pickling tank is placed in service or to abrasion from the parts handled, because the entire working face of the tank is ceramic material.

For lining old tanks, the bricks may be laid on edge to save material and working space. For floors or thick walls the bricks may be laid flat. These bricks are called "Sauer-Eisen" after the inventor, C. Fred Sauereisen, who is president of the Technical Products Co., Pittsburgh, Pa.

Monel Metal Helped Gar Wood to Win

When Gar Wood piloted *Miss America X* to victory in the Harmsworth Cup Race, winning the highest trophy in the motor-boat world, 6400 horsepower was transmitted to the propellers by shafts made of Monel metal. It was the first time that a non-ferrous material had been used for transmitting such tremendous power, according to the International Nickel Co., Inc.

The use of a nickel-copper alloy in the victorious craft was of particular interest to owners of motor boats used for pleasure purposes, since the same alloy has been employed extensively in boats of that classification because of its strength, rigidity, and corrosion resistance. The propeller wheels of *Miss America X* were also made of Monel metal.

Various Alloys Adapt One Pump for Different Chemicals

When the Model 2A centrifugal pump made by the Duriron Co., Dayton, Ohio, for handling corrosive chemicals is to be used for general acid service, the various parts are made of Duriron, which contains 0.80 per cent carbon, 14.50 per cent silicon, and 0.60 per cent manganese. When the pump is to handle hydrochloric acid, the pump parts are made of Durichlor, which contains 0.80 per cent carbon, 14 per cent silicon and 4 per cent molybdenum.

For handling weak sulphuric acid of any temperature, the pump parts are made of Durimet, a low-carbon, nickel-chromium-silicon alloy steel. For other applications, the pump parts are produced from Durco alloy steels, which are of the low-carbon 18-8 classification; Alcumite, a copper-aluminum-iron alloy; or from chemical lead alloys.

This pump has a capacity ranging from 2 1/2 gallons per minute at a 25-foot head to 25 gallons per minute at a 5-foot head. From 1/4 to about 1/2 horsepower is consumed in its operation.

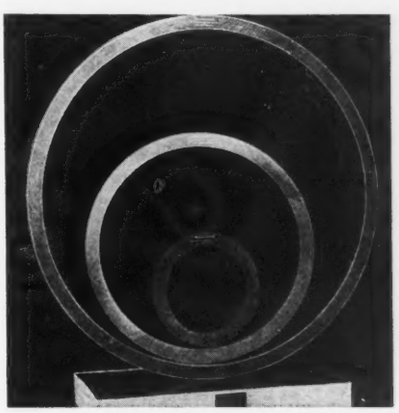
Are Airplane Metals Affected by Low Temperatures?

Extensive tests were recently conducted by the United States Army Air Corps to determine the effect of sub-zero temperatures on the metals of airplanes flying at high altitudes. Five nickel-chromium stainless steels were investigated, as well as a number of aluminum-base and magnesium-base alloys. It was found that the extremely cold temperatures encountered under such conditions do not affect the properties of the metals sufficiently to endanger the safety of the planes. The results indicated that aeronautical designers can safely use stresses as determined by testing the materials at normal temperature.

The temperature in the tests was minus 40 degrees C., which is also 40 degrees below zero F. This temperature corresponds approximately to that encountered when flying at an altitude of 30,000 feet.

Roll-Neck Bearings Made of Micarta

A new grade of Micarta has been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., for the radial part of roll-neck bearings that must withstand severe service. This new material is known as Grade 1C17. It is similar in texture to Grade 863, which is used for thrust plates on bearings. Both grades can be machined or sawed to any shape. They will withstand high thrust loads and pressures without delamination, splitting, or working out of the chuck.



Micarta Roll-Neck Bearings Intended for Severe Duty

Both grades are green in color, to distinguish them from Grades 1B21 and 262, which are used extensively in bar, rod, wire, and other small mills for bearings subjected to lighter pressures.

A Die Coating for Producing Smooth Die-Castings

A coating known as "Bonis" has been developed by the St. John X-Ray Service Corporation, 507 Fifth Ave., New York City, for use on the faces of dies employed in the production of aluminum and brass die-castings. This coating is said to protect the dies and result in a smooth high-grade finish on the castings. The same concern has supplied a die coating for a number of years which has given the same advantages in the production of zinc-base die-castings.

A Simple Gage Stop for Blanking Dies

By EDWARD HELLER, Cleveland, Ohio

On page 784 of August MACHINERY, there is a description of a blanking die gage that is claimed to have certain advantages over the ordinary gage. It has some undesirable features, however, one being that every time the die is sharpened, the recess for the stop blade in the die has to be made deeper. Of course, that could be helped by making the recess very deep in the first place, but that would form a weak point in the die.

Another objectionable feature is that the gage is fastened to the die-shoe, and as the die face becomes lower through sharpening, the gage or stop blade would have to be bent down correspondingly, thus changing the relation of the gage to the opening in the die. Also, the method of fastening the die with fillister-head screws in holes that are countersunk in the top or cutting face of the die is open to criticism. As the die is ground or sharpened, the counterbore for the fillister head of the screw will continually become shallower, and the screw or screws will either project above the face of the die or be gradually ground away to nothing.

The ordinary pin gage works very well when there is enough clearance between the top of the die and the bottom face of the stripper. When the punch pulls out of the opening in the strip, the strip is up high and above the pin. If the horizontal push to the left is applied at once, there is no trouble in moving the stock to the next stop. Even that can be improved upon, however, by grinding a small amount of shear in the middle of the die to make a low spot on a line running from front to back. This feature would deform the scrap sufficiently to allow it to ride over the gage pin.

* * *

Machineability of Screw Stock—Comment

By FRANK O. WELLS, Greenfield, Mass.

The article "The Machineability of Screw Machine Stock" on page 793 of August MACHINERY is very interesting, but relates mainly to the workability of steel. It seems to me that the shape of the cutting tool and how an edge is put on the tool should be given serious consideration as well. There is much that could be said regarding the proper rake and angle of the cutting tool for different materials. In most cases, this is left to the operator; and if he is a good guesser, he gets good production.

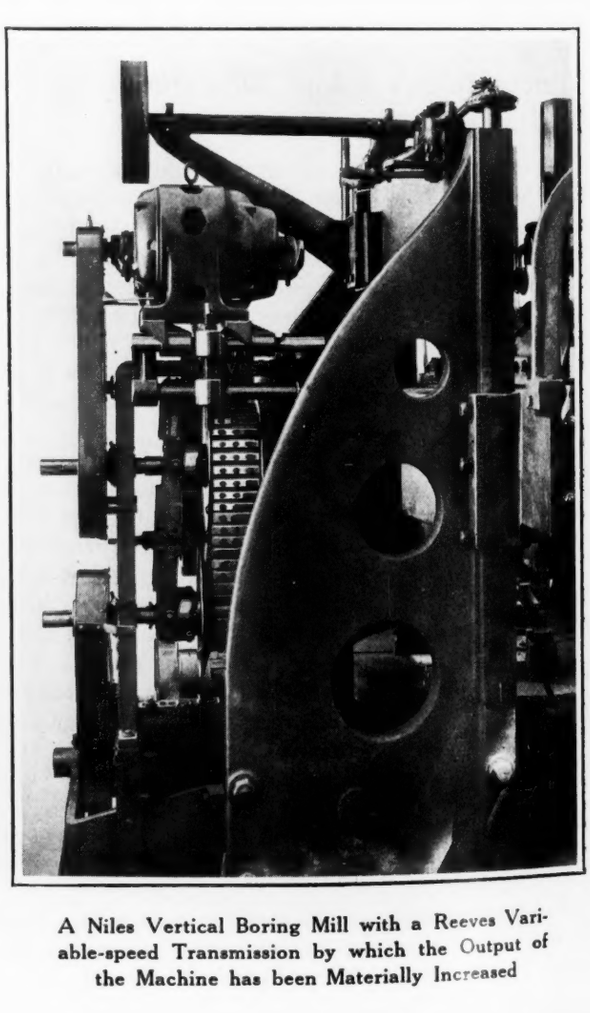
The best way is to have tests made and the best shape and angle for a tool established; then the operator should be furnished with a tool sharpener that will sharpen the tool correctly. This method eliminates guesswork.

The question of how often a tool is sharpened is important. If tools are allowed to run too long between grinds, the cutting speed must be reduced. It is more economical to operate at the highest speed of which the tools are capable and to sharpen the tools often. The sharpening machine should be close by, so that no time is lost in changing tools. The machine should preferably be a single-purpose unit. Careful honing will also prolong the life of a tool. The shape of the tool should be such that it cuts the metal instead of tearing it off.

* * *

Special Drive Adds Twenty-Five Per Cent to Boring Mill Efficiency

A recent installation of a Reeves variable-speed transmission on a Niles five-foot heavy-duty vertical boring mill has made it possible to obtain remarkable results in the plant of the Mokry & Tesmer Machine Co., Middletown, Ohio. According to an official of the company, the efficiency of the machine has been increased 25 per cent by the addition of the Reeves transmission, which enables speed changes to be made instantly and without stopping the machine. While the transmission provides only a 6 to 1 speed ratio, the system of change-gears makes it possible to operate the work-table at speeds ranging from 1 2/3 to 30 1/2 revolutions per minute.



A Niles Vertical Boring Mill with a Reeves Variable-speed Transmission by which the Output of the Machine has been Materially Increased

NEW TRADE LITERATURE

Any of these Publications can be Obtained by Writing to the Manufacturer or to MACHINERY. Send for Your Copy Today.

FLEXIBLE SHAFT DRIVEN TOOLS AND EQUIPMENT. S. S. White Dental Mfg. Co., Industrial Division, 150 W. 42nd St., New York City. Catalogue TA covering the S. S. White line of flexible shaft driven tools and equipment. The booklet contains complete lists of applications of these tools, one list, as reported by the users, giving the operations for which they are adapted, the parts on which the work is done, and the tools used. Illustrations and specifications of the various outfits are given, and instructions for selecting the proper equipment are included. A list of the tools used with this flexible equipment, including milling burrs, abrasive points, wheels, and disks, rotary files and mandrels, is given at the end of the book. Of interest to the draftsman is the flexible shaft erasing outfit described.

CARBON STEELS. Carnegie Steel Co., Pittsburgh, Pa. Catalogue dealing with Carnegie "Controlled" carbon steels. The catalogue is divided into five parts as follows: Part I: Carbon Steel Quality Factors and the Need for Control; Part II: Some Carbon Steels Manufactured by the Carnegie System of Control—Physical Properties of Different Types after Heat-treatment; Part III: Importance of Controlled Steel Making to the Steel Consumer; Part IV: Carnegie System for Controlling Quality Factors; Part V: A Classified Bibliography of Inherent Quality Factors of Steel. Steel users will find much valuable information in this book.

ELECTRIC GAGES. Pratt & Whitney Co., Hartford, Conn. Catalogue illustrating and describing a new inspection gage known as the "Electrolimit" gage, which combines mechanical gaging with electrical magnification to obtain either external or internal measurements. This gage is a comparator, set to maximum and minimum master standards. The catalogue describes the various features of the gage and illustrates a few of its many applications, as well as the different models which are made to suit a variety of work.

MACHINE TOOLS. Walker-Turner Co., Inc., Plainfield, N. J. Catalogue introducing a new Driver line of power-driven tools, designed to meet the needs of the present day by combining high quality and low price. Among the tools shown are bench saws, lathes, drill presses, bench grinders with abrasive disk cutting-off attachment, flexible shaft machines, portable bench wood planers, band saws for both wood and metal, and bench filing machines. A new friction clutch is also featured.

STAINLESS-CLAD STEEL. Ingersoll Steel & Disc Co. (Division of the Borg-Warner Corporation), 310 S. Michigan Ave., Chicago, Ill. Folder illustrating many different applications of "IngOclad" stainless clad steel. The text of the folder deals with the application of "IngOclad" in almost every phase of the metal-working and process industries where the corrosion resistance and sanitation of stainless steel are desired, combined with low cost of the fabricated product.

CONTOUR MEASURING PROJECTORS. Bausch & Lomb Optical Co., Rochester, N. Y. Catalogue describing the construction and operation of the contour measuring projector, an optical instrument for the precise measurement of small parts. The many applications illustrated will give an idea of the wide variety of work for which this equipment is applicable. Specifications and prices are included.

COUPLINGS. Farrel-Birmingham Co., Inc., 377 Vulcan St., Buffalo, N. Y. Bulletin 437, entitled "Farrel Gearflex Couplings," illustrating and describing the line of flexible couplings manufactured by this company. Tables of ratings, weights, dimensions, and list prices, as well as complete descriptive matter and information for ordering these couplings, are given.

HARDENING EQUIPMENT. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Bulletin L-960, descriptive of the essential features of the Vapocarb Hump method of hardening and its advantages. A concrete example of the results obtained with this method is given, illustrated by a photograph and chart. Sizes, capacities, and prices of the equipment are included.

INDICATING, RECORDING, AND CONTROLLING INSTRUMENTS. Brown Instrument Co., Philadelphia, Pa. Folder entitled "Hundreds of Dollars Saved by Analyzing Chart Records," briefly describing the Brown line of indicating, recording and controlling instruments for the measurement of temperature, flow, carbon dioxide, pressure, speed, and liquid level.

ZINC PRODUCTS. New Jersey Zinc Sales Co., Inc., 160 Front St., New York City. Folder entitled "Case Histories in Product Design," containing six articles describing the development of the design of various products, as well as the results of ingenious methods of manufacture and the application of economical materials.

GROUND THREAD DIES. Jones & Lamson Machine Co., Springfield, Vt. Catalogue describing J & L tangent chasers and tangent dies. The special features of these tools are pointed out, and a die data sheet giving capacities and dimensions of revolving and stationary dies, as well as tables of standard stock chasers, is included.

METAL-CLEANING SOLVENT. Rex Products & Mfg. Co., 13005 Hillview Ave., Detroit, Mich. Circular descriptive of different methods of cleaning metal by the use of a sol-

vent known as "Perm-A-Clor." The essential steps in the various processes and the equipment used for different classes of cleaning are described.

WELDING EQUIPMENT. Air Reduction Sales Co., Lincoln Bldg., 42nd St., New York City. Leaflet entitled "At Last—Automatically Maintained Pressure Regulation," listing the outstanding features and advantages of the new Airco two-stage reduction oxygen regulators and acetylene regulators for use in gas welding.

TUMBLING BARRELS. Baird Machine Co., Bridgeport, Conn. Circular describing the Baird line of ball burnishing tumbling barrels and suggesting points to be observed in polishing work with this equipment. Specifications are included both for the tilting barrels and for the small horizontal barrels.

FLOOR PLATES. Inland Steel Co., First National Bank Bldg., Chicago, Ill. Folder on Inland four-way floor plates, describing in detail the different types of floor plates in this line and illustrating some of their many applications. All the sizes and standard extra data needed by the user are given.

STEEL STRAPS. Acme Steel Co., Chicago, Ill. Circular illustrating the use of steel straps for packing cases, where safety in shipping is essential. The folder also shows various designs of cases, and outlines the service offered by the Packing Testing Laboratory of the company.

GLUE FOR POLISHING. Divine Bros. Co., Utica, N. Y. Folder entitled "Lower Polishing Costs, Longer Wheel-head Life, and Better Finish —a Direct Result of the Divine Standard Glue System," descriptive of the Divine glue system for use in connection with polishing operations.

GAS ELECTRIC SETS. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Publication C.1959-A entitled "Gas Electric Sets for Every Application," describing the outstanding features and applications of these sets which range in size from 800 watts to 100 kilovolt-amperes.

PREVENTION OF INDUSTRIAL SKIN INFECTIONS. Milburn Co., Free Press Bldg., Detroit, Mich. Circulars 223 and 224, describing protective skin creams for the prevention of skin infection caused by cooling lubricants, plating compounds, and oil emulsions in industrial plants.

PIPE-CUTTING AND THREADING EQUIPMENT. Borden Co., Warren, Ohio. Circular illustrating typical examples of the Beaver line of pipe-cutting and threading equipment, including electric pipe machines, dieheads, square-end pipe cutters, tubing cutters, and wheel cutters.

PHOTO-ELECTRIC RELAYS. General Electric Co., Schenectady, N. Y. Bulletin GEA-1654A, descriptive of the features of G-E photo-electric relays and their principles of operation. The circular also lists the many different applications for which this equipment is being used.

VALVES. Jenkins Bros., 80 White St., New York City. Catalogue containing 264 pages of information on valves and valve lay-out. The book shows 400 different types of Jenkins valves, and contains a section of engineering data of value to the valve user.

MAGNETIC SEPARATORS. Patterson Foundry & Machine Co., East Liverpool, Ohio. Circular illustrating the construction and principle of operation of the Patterson high-intensity magnetic separator for removing metallic particles from fluid solutions.

MOTORS. Emerson Electric Mfg. Co., 2018 Washington Ave., St. Louis, Mo. Circular illustrating and describing the new capacitor start, induction-run Emerson motor for application where high starting torque and quietness of operation are essential.

PORTABLE ELECTRIC INSTRUMENTS. General Electric Co., Schenectady, N. Y. Leaflet describing a new line of portable electric instruments, including voltmeters, milliammeters, ammeters, and wattmeters, designed for general-utility commercial testing.

SCREW MACHINE REAMERS. Pratt & Whitney Co., Hartford, Conn. Leaflet descriptive of stub reamers, made in decimal sizes, for accurate production work on screw machines. A table lists the various sizes of blanks carried in stock and the ranges they cover.

AIR COMPRESSORS. Worthington Pump & Machinery Corporation, Harrison, N. J. Catalogue illustrating and describing the Worthington vertical duplex portable compressors, equipped for either gasoline engine or electric motor drive.

DIE-CASTING MACHINES, AIR TOOLS, AND LUBRICATORS. Madison-Kipp Corporation, 203 Waubesa St., Madison, Wis. Circular illustrating typical examples of the lines of air tools, lubricators, and die-casting machines built by this company.

ELECTRIC WIRE-STRIPPING MACHINERY. Wenco Mfg. Co., 3048 Sheffield Ave., Chicago, Ill. Circulars illustrating and describing Simplex wire-stripping machinery, both hand- and power-operated, and Simplex wire cutters.

LUBRICANTS. Armite Laboratories, 1450 E. 61st St., Los Angeles, Calif. Leaflet outlining the characteristics and applications of Bestolife, a metallic lead lubricant, which is made in different grades for various classes of work.

LOCOMOTIVE FEED-WATER HEATER. Worthington Pump & Machinery Corporation, Harrison, N. J. Catalogue describing the construction and operation of the Worthington Type SA locomotive feed-water heater equipment.

IRON AND STEEL. Oliver Bros., Inc., 200 Hudson St., New York City, is distributing a table of market values of the principal iron, steel, wire, and metal materials from December, 1897, to August, 1933, inclusive.

AGITATORS. Patterson Foundry & Machine Co., East Liverpool, Ohio. Bulletin illustrating and describing Patterson "Unipower" self-contained agitators with in-built motor and speed reducer unit of special design.

SAW AND KNIFE GRINDING MACHINERY. Samuel C. Rogers & Co., 191 Dutton Ave., Buffalo, N. Y. New price list covering Rogers saw and knife grinding machinery and other sharpening machines.

BALL BEARINGS. New Departure Mfg. Co., Bristol, Conn. Loose-leaf circular 205 FE, illustrating and describing the application of ball bearings in helical-geared speed reducers.

COLLOIDAL GRAPHITE. Acheson Oildag Co., Port Huron, Mich. Technical bulletin M-11, dealing with the use of colloidal graphite in the manufacture of electrical resistances.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts and Material-Handling Appliances Recently Placed on the Market

Ajax Quick-Acting Multiple-Disk Air Clutches

Quick-acting pneumatically operated clutches are now being manufactured in capacities from 100 to 1000 horsepower at a speed of 100 revolutions per minute, by the Ajax Mfg. Co., Cleveland, Ohio. Although developed primarily for use on the forging machines and various types of hot metal-working machinery that this company builds, these clutches are available for initial use and replacement on all types of stop-motion machines.

Through the substitution of a simple housing for the combination flywheel and pulley rim, the clutches become equally serviceable for purely power transmission applications, such as connecting prime movers with lineshafting, pumps, compressors, and hoists, where smooth action and true balance are essential with high rotating speeds and great torque capacity. Fig. 1 shows a 30-inch clutch-flywheel with a splined outside driving ring. Fig. 2 shows an 18-inch clutch assembly.

In these multiple-disk friction type clutches, pressure is applied to the friction surfaces by introducing compressed air behind an annular piston that acts directly upon the plates. In Fig. 3, which shows a disassembled clutch, the piston can be seen in the annular cylinder of the side plate. The only operating parts, aside from the piston and plates, are compression springs which retract the piston and disengage the plates when the air pressure is released. The air consumption is extremely small, due to the negligible clearance volume in the cylinder above the piston and to the short piston stroke. The stroke is only 1/8 inch on four surface clutches and 3/16 inch on six surface clutches. The construction makes it possible to start and stop very quickly.

The clutch is engaged by simply opening an air valve. Disengagement occurs when the valve is reversed to exhaust the air. In the case of stop-motion machines, this valve is timed into the machine cycle, an air-released spring-set brake stopping

Fig. 1. Ajax Pneumatic Clutch-Flywheel for Forging Machines, Presses, and Similar Equipment

Fig. 2. An 18-inch Clutch Assembly of the Ajax Line, which is Made in Sizes from 100 to 1000 H.P.

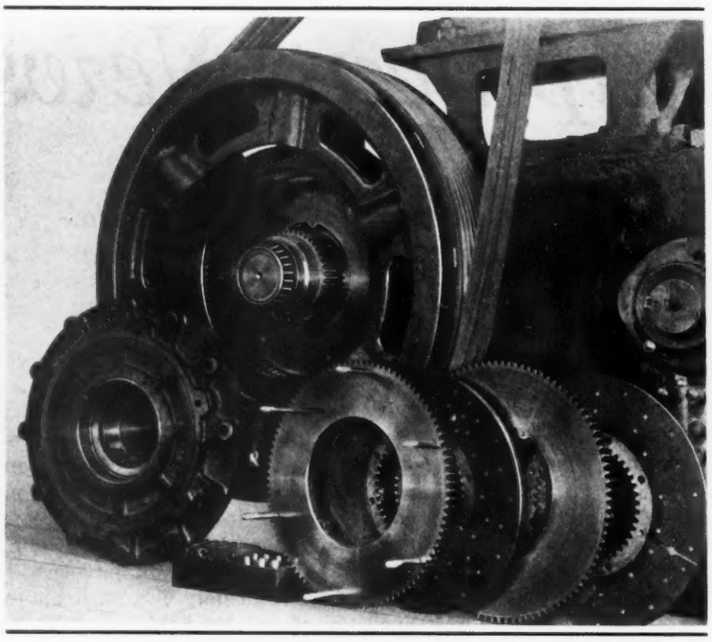


Fig. 3. Ajax Clutch Disassembled, Showing the Ring Type Operating Piston in the Side-plate Cylinder

the machine at open stroke. A sudden drop of air pressure or the breaking of an air line will stop the machine instantly.

Inasmuch as the cylinder, piston, and heavy cast-iron driving plates are in rotation, the only clutch parts to be started and stopped are the driven plates and the clutch pinion. By using a small secondary air cylinder or a solenoid for actuating the air valve, a multi-station or remote control is possible.

Landis Air-Sizing Device for Grinding Machines

The hydraulically operated grinding machines built by the Landis Tool Co., Waynesboro, Pa., can now be equipped with an air-sizing device that is universal in application, fully automatic, and of simple design. It can be used for both external and internal grinding operations of all kinds. External surfaces can be sized, whether they are straight, tapered, radial, splined, or keywayed, and internal surfaces, whether straight, tapered, splined, keywayed, interrupted, or blind. Radial internal surfaces can also be sized, which makes the device especially useful in grinding raceways.

This air-sizing device requires no attention during an operation. Through the medium of solenoids and hydraulic valves, it can be made to control as many machine movements as desired. Work can be sized within limits of 0.00025 inch. Since no mechanical movement takes place, wear is not a factor.

The operation of this device is based on the principle that if air escapes from a pressure line, the pressure is affected by the size and shape of the outlet through which the air passes. Fig. 1 shows a typical sizing head for external grinding. When the work is placed between centers, it rests lightly against two diamond points between which there is an air outlet.

As the grinding proceeds, the sizing head swings upward slightly, decreasing the size of the gap between the work and the outlet. Pressure builds up slowly in the air line, causing mercury to rise in a U-tube. Just before the work reaches the fin-

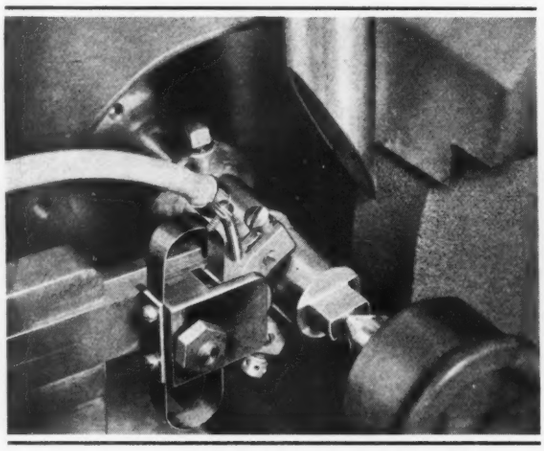


Fig. 1. Landis Sizing Device that Utilizes Both Air Pressure and Mercury

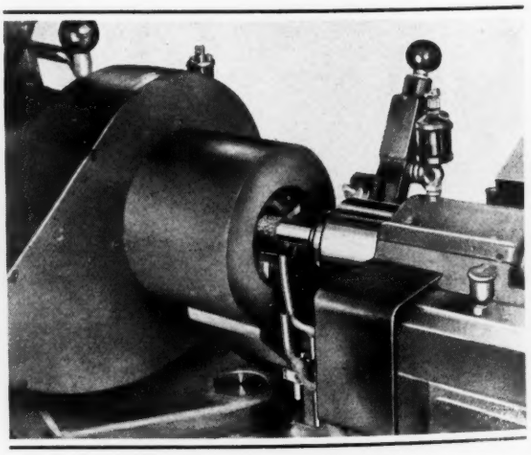


Fig. 2. Style of Air-sizing Device Used in Internal Grinding Operations

ished size, the mercury touches a contact, completing an electrical circuit and energizing a solenoid which slows down the speed of the feeding-in movement.

Grinding continues until the finished size is reached, the mercury having then risen in the tube until it touches a second contact. This completes another electrical circuit which energizes a second solenoid, moving the wheel rapidly away from the work. Should the nature of the work permit it, the wheel can be fed back from the work without employing the slower feeding-in movement.

Fig. 2 shows a typical internal grinding application. The tube that carries the compressed air to the ground surface is visible below the grinding wheel. It never comes into contact with the work. In some applications, a second tube is used as shown. As grinding proceeds, the inside diameter of the hole increases and the size of the gap between the outlet and the work becomes greater. The gradual decrease of pressure in the air line causes the mercury in the U-tube to function, making electrical contacts in a manner similar to that explained in connection with the external device.

Weston Photronic Kit

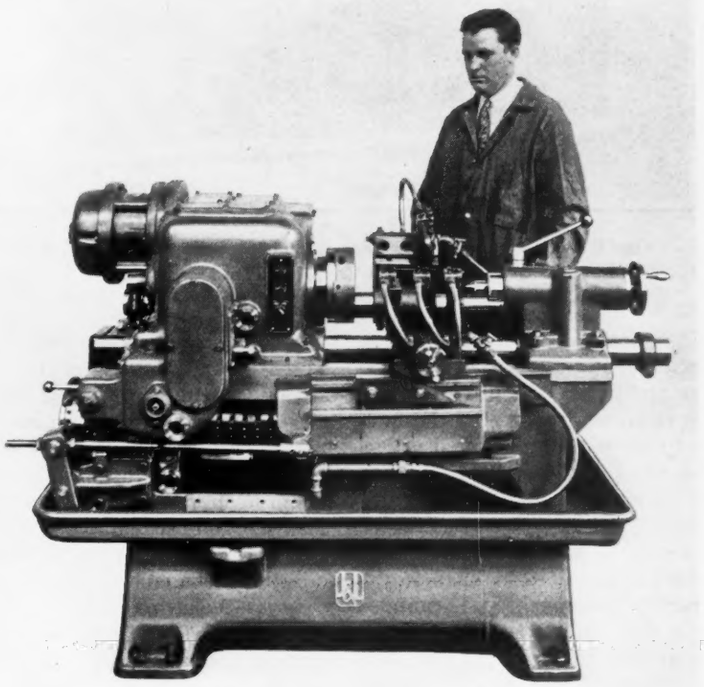
An inexpensive photo-electric control kit, known by the trade name "Photronic," has been placed on the market by the Weston Electrical Instrument Corporation, 614 Frelinghuysen Ave., Newark, N. J. This equipment is intended especially for engineers and manufacturers who prefer to do their own experimenting with photo-electric control for mechanical equipment and for operations and processes of various kinds.

The kit contains all the equipment necessary for immediate experiment, together with diagrams of connections. It can be used as a smoke detector, burglar alarm, door opener, counting device, and safety device on machines, etc.

The spectral response of the equipment is about the same as that of the human eye, so that it is very sensitive to color changes, and therefore will find wide application wherever processes must be controlled by changes in color.

Fay Automatic Lathe for Small Work

An 8-inch Fay automatic lathe intended for machining washing-machine and refrigerator parts, valves, valve stems and bushings, small shafts similar to those of automobile starters and generators, small pistons, etc., has been brought out by the Jones & Lamson Machine Co., Springfield, Vt. The machine is also adapted for light finishing operations on large work, such as automobile transmission shafts and other transmission parts.



Fay Automatic Lathe of Small Size for Such Work as Washing-machine, Refrigerator, and Automobile Parts

The new machine has the same tooling possibilities as the larger Fay lathes. Multiple tooling can be arranged on the carriage for straight or taper turning. The back arm is designed for facing or forming any number of shoulder lengths or diameters. A third cutting head or auxiliary attachment can be installed for turning or facing.

The headstock is equipped with a built-in motor controlled by push-buttons on a panel at the front of the machine. The electrical control box and wiring are built into the machine. By moving a switch on the panel, the spindle can be jogged with the starting button. A solenoid brake is built into the headstock for stopping the machine. Pick-off change-gears provide a wide range of spindle speeds.

Cams on the drum control all tool movements of the carriage,

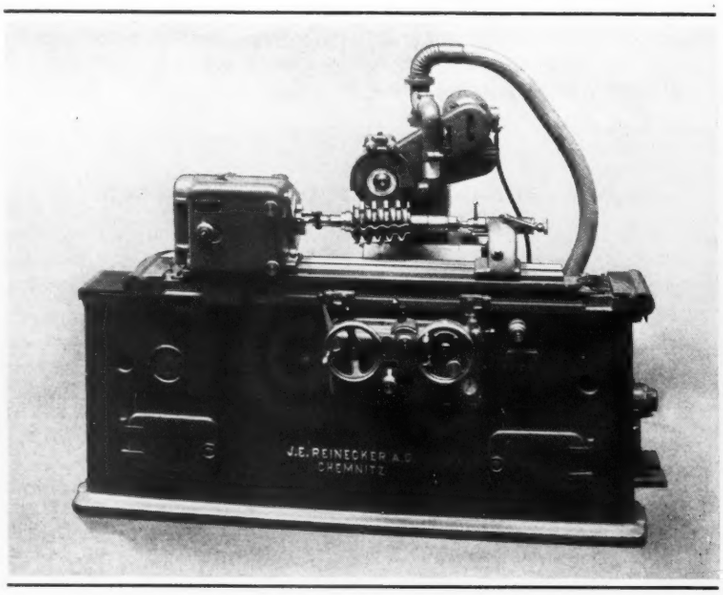


Fig. 1. Universal Tool-grinder with Hydraulic Table Feed and Hydraulic Dividing Head

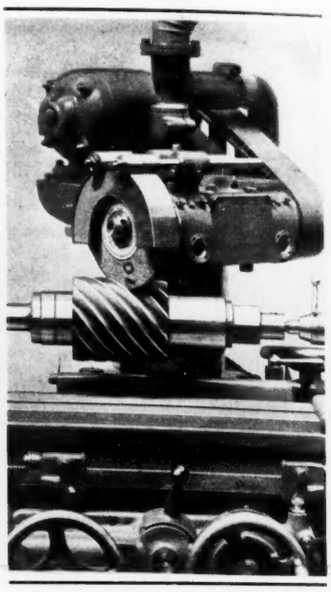


Fig. 2. Setting of Wheel-head in Grinding a Worm Thread

brake arm, and auxiliary facing attachment. Another drum at one end of the machine provides for conveniently setting the fast- and slow-motion dogs and relieving cams for the front carriage or turning head. The fast motion of the machine is obtained through a clutch at the back which is operated by dogs on the drum. The machine is stopped by a dog coming in contact with an automatic switch. Three sets of feed-change pick-off gears give six different rates of carriage feed, ranging from 0.004 to 0.040 inch per revolution, with the standard carriage cam. Faster or slower feeds can be obtained by using special cams or special feed gears.

The carriage or turning head is adjustable on the center bar to suit various work. It has a cross-slide that is controlled by means of a lead-screw and a graduated handwheel. The carriage is supported on a hardened and ground adjustable former, which is mounted on a relieving slide. At the end of the turning cut, the tools can be relieved, so that the work will not be scored during the automatic return stroke.

The back arm is operated by a hardened and ground former. It is equipped with an adjustable follower shoe so that it can be easily adjusted to suit various diameters. This machine is built in two lengths.

Universal Tool-Grinding Machine

Cutters for spur gears and worm-wheels, cylindrical and profile cutters, and other tools can be sharpened in a Reinecker universal tool-grinding machine which is being placed on the market by the George Scherr Co., 128 Lafayette St., New York City. The range of application can be extended to include cylindrical, internal, face, and surface grinding through the use of attachments. The cylindrical grinding attachment can be swiveled 90 degrees for taper and face grinding operations.

The machine is built on the lines of a cylindrical grinder, the work-table having a reciprocating motion. The grinding head is arranged on a column and is adjustable vertically and crosswise. The work-table is reciprocated hydraulically and the automatic dividing head is indexed by hydraulic means. The cross movement of the grinding slide is obtained through a handwheel. However, for external, internal, and face grinding with set limits, the cross movement can be made to take place automatically with each table reversal.

The grinding head can be swiveled 360 degrees and locked at any angle. Fig. 2 shows the grinding head set at an angle for finishing the thread of a worm. The grinding spindle is driven through multiple Texrope belts. Either end of the grinding spindle may be equipped with a disk, cup, or bevel wheel to suit the operation. Fig. 1 shows the machine grinding the flutes of a hob.

For external or internal grinding of tapered work, the upper table can be swiveled on the lower table. Precise settings are obtainable by means of a micrometer screw. The rate of hydraulic table movement is regulated by a throttle valve and the length of the movement by means of adjustable stops. The hydraulic dividing head has an automatic spacing arrangement and an adjustable feed-in motion. The automatic spacing takes place after each table stroke.

Baird Automatic Multiple-Transfer Presses

Multiple-transfer presses intended for applications where the work must be transferred to several positions after blanking for the performance of piercing, forming (one or more times), lettering, embossing, etc., have been developed by the Baird Machine Co., Bridgeport, Conn. The material is automatically fed from a coil. Pressing, lettering, and similar operations may be performed prior to blanking, and after the blank has been cut, it may be transferred to several other tool stations and finally ejected. The entire operation is performed at high speed.

The material is fed by a cam-operated slide, the stroke of which can be closely adjusted by means of a screw. The blanking punch enters the die just enough to cut the blank. The blank is securely held as it is carried down through the die into transfer fingers. These fingers retain a grip on the work until forming or other tools take hold. The work is gripped by the next set of transfer fingers before the tools let go.

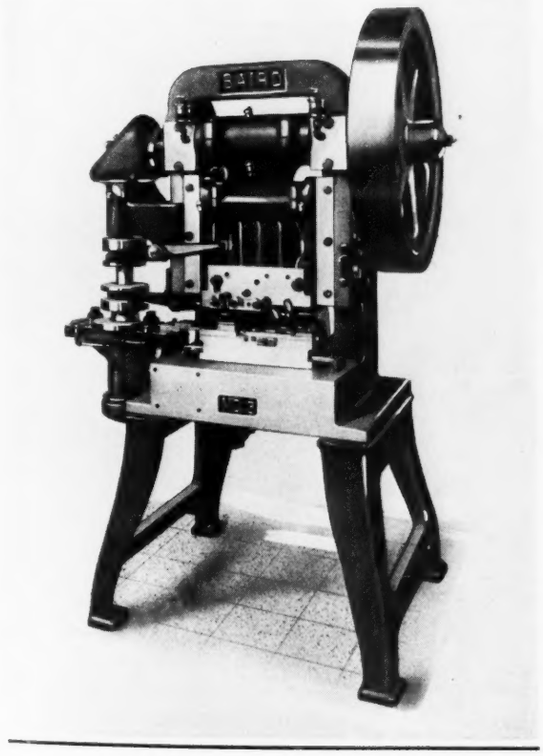
The arrangement of the multiple-transfer mechanism is such that cams can readily be supplied to give different lengths of stroke. All the punches are contained in one punch-holder, but each is provided with an independent adjustment. All dies are contained in one shoe. These multiple-transfer presses are made in six sizes, ranging in weight from 1100 to 8700 pounds. The maximum width of metal that can be handled by the smallest size is 1 1/2 inches, and by the largest size, 6 inches.

Geometric Chaser-Grinding Equipment

Chasers for die-heads and taps of any kind or make can be sharpened in a grinding machine designed specifically for this class of work by the Geometric Tool Co., New Haven, Conn. Because of its longitudinal, transverse, and vertical movements the machine is also adaptable for other tool grinding work.

This chaser-grinding machine, which is shown in Fig. 1, is supplied with or without the Style E universal chaser-grinding fixture shown in Fig. 2. When purchased for grinding chasers, the manufacturer recommends that the machine be equipped with this fixture and with such holders as may suit the Geometric chasers that the customer is using. The chaser-holders, one for each size of chaser blank, are mounted on the fixture. They can be swung under the grinding wheel for chamfering and face-grinding at practically any angle.

Fine feeds are obtainable through micrometer table adjustments. There are scales to in-



Baird Press which Automatically Transfers Stampings to Several Positions after Blanking

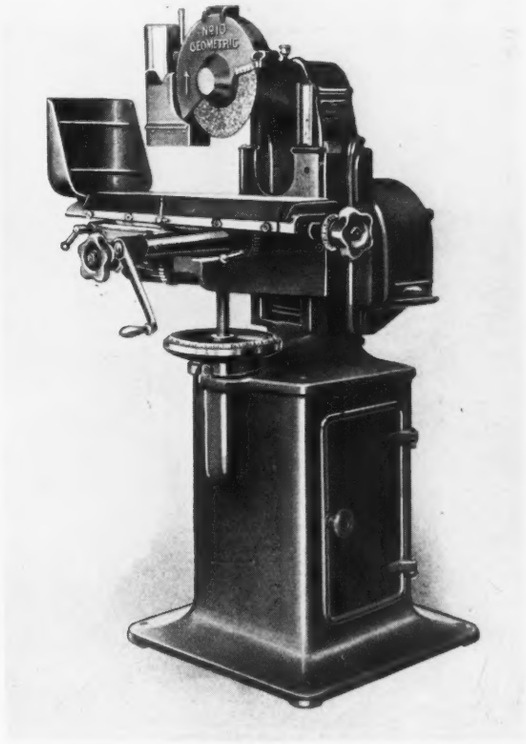


Fig. 1. Geometric Machine for Sharpening Die-head and Tap Chasers of All Kinds

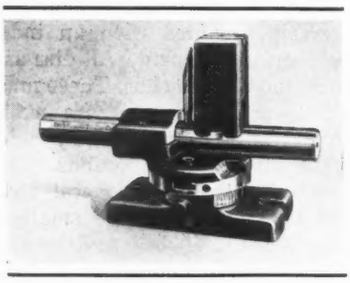


Fig. 2. Improved Geometric Universal Chaser-grinding Fixture

dicate the diameter of the wheel and the vertical table travel. Micrometer feed-screw dials insure even grinding of chasers.

A number of improvements have been made in the Style E universal chaser-grinding fixture since this fixture was first brought out, as described on page 120-A of October, 1929, MACHINERY. For example, a plate has been added which permits the fixture to be offset in order to give the proper chamfer clearance on tapped (hobbed) die-head chasers or collapsing tap chasers. This offset plate is equipped with opposing screws that permit fine adjustments to be made. Another feature is the tongue-and-groove fastening of the holder on the fixture bar.

Olsen Automatic-Weighing Static Balancing Machine

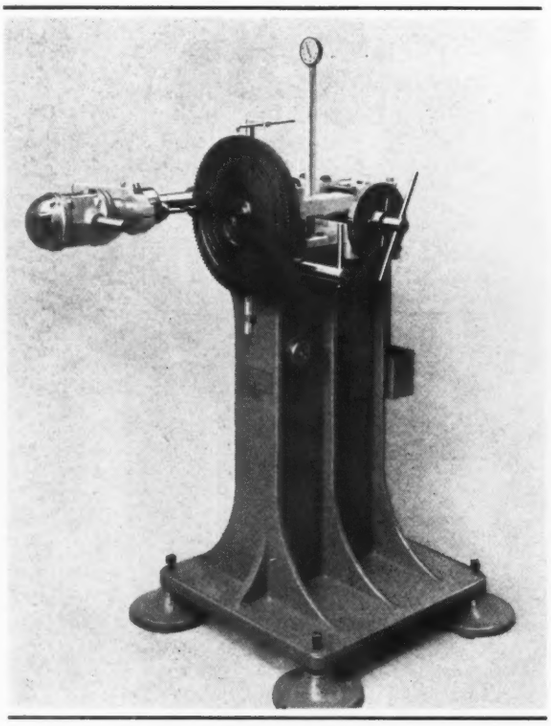
A static balancing machine designed with a view to obtaining maximum production with equipment operated by hand is a recent development of the Tinius Olsen Testing Machine Co., 500 N. 12th St., Philadelphia, Pa. This machine is suitable for balancing flywheels, clutch parts, and similar parts or units that do not require dynamic balancing.

The operation consists merely of mounting the work on an adapter fitted to the spindle of the machine, with the weighing system locked in position. The part to be balanced is turned on its mounting until the dial indicates zero. At this stage, the pointer seen at the top of the flywheel in the illustration indicates the angle of unbalance. The work is then turned 90 degrees, with the weighing system released, when the pointer on the dial indicator will show the amount of static unbalance.

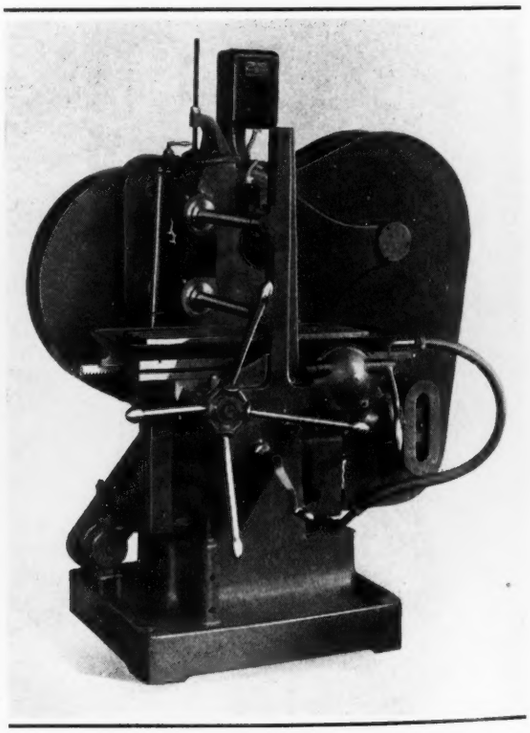
The machine is shown fitted with an electric drill for correcting parts that are out of balance. This equipment is made in six sizes for use in the balancing of work weighing from 2 to 20,000 pounds. The unbalance may vary from 0.030 to 500 ounce-inches.

Variable-Speed Miller with Double Spindles

A combination of two spindles with a variable-speed drive is the feature of a new milling machine being placed on the market by the Kent-Owens Machine Co., 958 Wall St., Toledo, Ohio. The



Static Balancing Machine Made in Different Sizes for Parts Weighing from 2 to 20,000 Pounds



Kent-Owens Two-spindle Miller with Speeds Infinitely Variable between Maximum and Minimum

center distance between the spindles is adjustable over a wide range, there being two standard ranges of from 4 3/4 to 7 5/8 inches and from 5 3/4 to 9 1/4 inches. Other ranges can be provided for special requirements. Any 3 to 1 spindle speed range is available between a minimum of 40 revolutions per minute and a maximum of 457 revolutions per minute, using a motor running at 1160 revolutions per minute.

Power is transmitted from the motor to a back-shaft through a combination vee-and-flat belt. This belt runs on a plain pulley on the back-shaft and between two opposed cones on the motor shaft. Adjusting the motor toward the back-shaft causes the belt to run near the outer circumference of the cones, thus increasing the spindle speed. Lowering the motor causes the belt to run on a smaller diameter of the cones and thus decreases the spindle speed. The motor is adjusted by a handle at the front of the machine.

This machine has a table working surface of 28 by 7 inches. It can be fed 17 1/2 inches, either by power or by a star handwheel. The cross-saddle feed is 7 inches.

Lincoln Beer-Barrel Welding Machine

An automatic machine for welding metal beer barrels by the shielded-arc process has been developed by the Lincoln Electric Co., Cleveland, Ohio. Equipped with an Electronic Tornado automatic welding head, this machine has a capacity for producing thirty or more barrels an hour, depending upon their type and size. Single or double automatic welding heads can be provided.

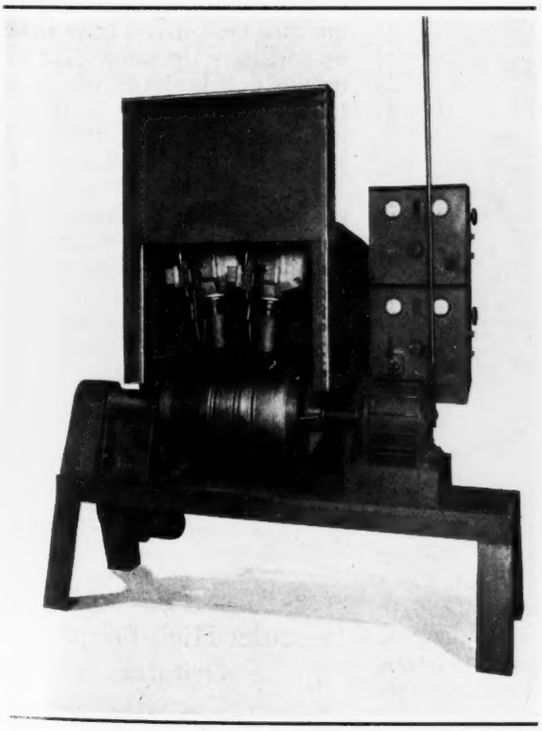
In operation, the welding heads are stationary, the barrels being revolved automatically. Arc-welded beer barrels are usually designed for lap or butt welds.

Barrels welded by this machine can be of either the single or the double shell type. Both inner and outer shells can be automatically welded. Some barrels are so designed that a single circumferential butt weld joins two half shells to form an inner shell in one piece. Halves of an outer shell, when placed over the inner shell, form two parallel circumferential joints with the inner shell.

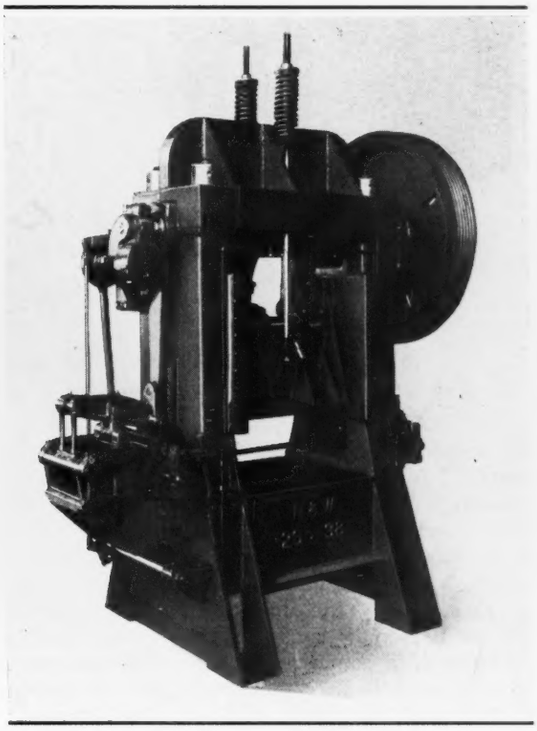
The design of another barrel is such that two circumferential seams can be welded simultaneously to fabricate the inner and outer shell in a single welding operation.

Henry & Wright Automatic-Feed Steel Presses

A line of welded-steel presses embodying various automatic features typical of the dieing machine made by the Henry & Wright Mfg. Co., Hartford, Conn., is being introduced on the market by the same concern. These presses are of tie-rod con-



Automatic Machine for Welding Beer Barrels by the Shielded-arc Process



Henry & Wright Steel Press with Automatic Feed for High-speed Operation

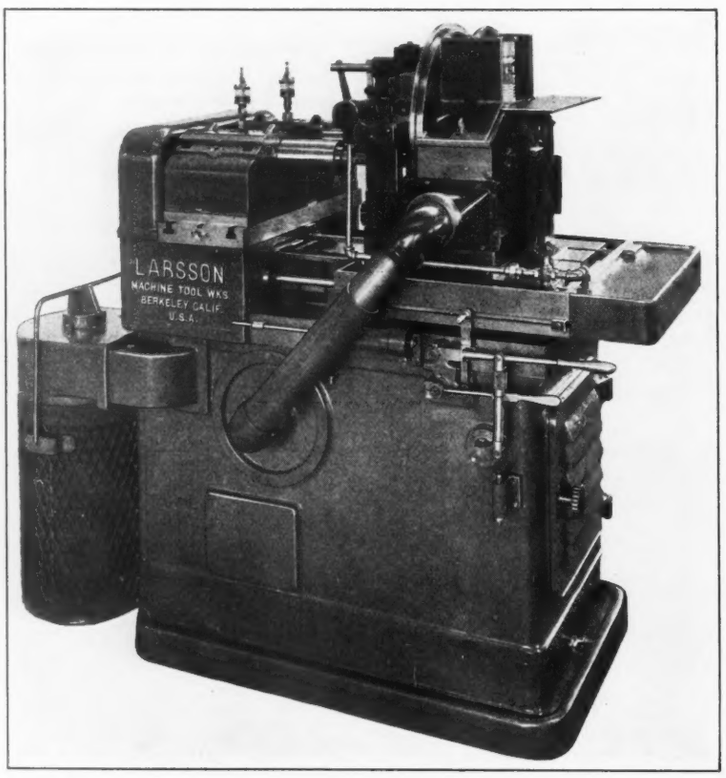
struction. The bed, uprights, crown, and slide are constructed from steel, and normalized and annealed before machining, so as to release any stresses and eliminate the possibility of distortion. A spring-counterbalanced slide, positive clutch, releasing brake, and a single and continuous operating lever are provided as standard equipment.

Automatic double-roll feeds of the type used on the dieing machine are included. Hardened rolls ground to close limits provide feeding accuracy at high speeds. The rolls are actuated through a ratchet and pawl mechanism. The outgoing rolls are driven from the crankshaft through helical gears and a driving rack, while the incoming rolls are driven in synchronism by means of a connecting rack. The feed pitch is adjustable and the timing of the feeding action can be varied in relation to rotation of the crankshaft.

While it is not claimed that the new presses will give results equal to those obtained with the dieing machine, the maker states that the rigidity of the machines, together with their precision roll feeds, makes possible the use of progressive dies in the high-speed production of close-limit stampings. The press illustrated has a 5-inch crankshaft and measures 38 inches between uprights. Material up to 12 1/2 inches in width can be handled by the feeds at a maximum pitch of 8 1/2 inches. An automatic scrap cutter is provided.

Larsson Precision Boring Machine

A precision boring machine intended for use with either diamond or tungsten-carbide tools is being introduced to the trade by the Larsson Machine Tool Works, 950 Parker St., Berkeley, Calif. This machine is suitable for boring automobile pistons, connecting-rods, cylinders and cluster gears, motor ends, etc. It is equipped with a mechanical feed control and rapid traverse and a hydraulic table control. The boring feeds and rapid traverse are controlled by a hardened lead-screw. Individual motor drives are supplied for each of the machine units, all motors being located in the machine base, which is thoroughly ventilated.



Precision Boring Machine Designed for Short or Long Production Runs

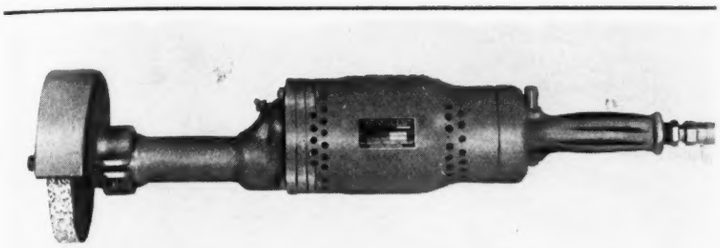
The tool-spindles are of quill form. They are equipped with ball bearings for taking belt strain and end thrust and with a non-adjustable Nitralloy bearing at the front end, close to the cutting tool. The spindle quills are mounted in heads that are adjustable vertically and horizontally by means of micrometer screws. The horizontal adjustment permits a minimum center distance of 4 1/2 inches and a maximum center distance of 17 inches. The vertical adjustment is 2 inches.

A one-horsepower motor with a solenoid brake, located in the machine base, drives the spindles and actuates the table. The hydraulic unit is also located in the base and is driven by a 1/4-horsepower motor. Two 1/4-horsepower motors drive the fans.

The machine as shown is equipped with a three-station automatic indexing fixture for simultaneously rough-boring and finish-boring piston-pin holes. Any piston up to 5 inches in diameter can be accommodated. By varying the thickness of locating plates, the center distance of the piston-pin holes can be changed in relation to the head of the piston without disturbing the setting of the machine. The operation is fully automatic.

Hercules High-Frequency Grinder

The Buckeye Portable Tool Co., Dayton, Ohio, has just placed on the market another tool of the high-frequency elec-



Hercules Grinder with Cool-running Characteristics

tric type. It comprises a No. 61 grinder, which is built in two speeds—3800 revolutions per minute for use with 6-inch vitrified emery wheels, and 5400 revolutions per minute for use with 6-inch elastic bonded emery wheels. The slower speed tool can also be used with 8-inch elastic bonded wheels.

The features of this grinder include a cool-running motor, stream-line ventilating system, and mounting of the stator on insulating pads within the motor housing. The results are a low temperature rise in operation and increased efficiency. The plug-in cable is so designed that it can be changed on the job.

Milwaukee Rail-Type Milling Machine

The Kearney & Trecker Corporation, Milwaukee, Wis., has added a rail-type milling machine to its line of machine tools. This machine is designed to use tungsten-carbide cutters to the limit of their possibilities. However, it can be furnished with optional speed ranges basically suited for other cutting metals.

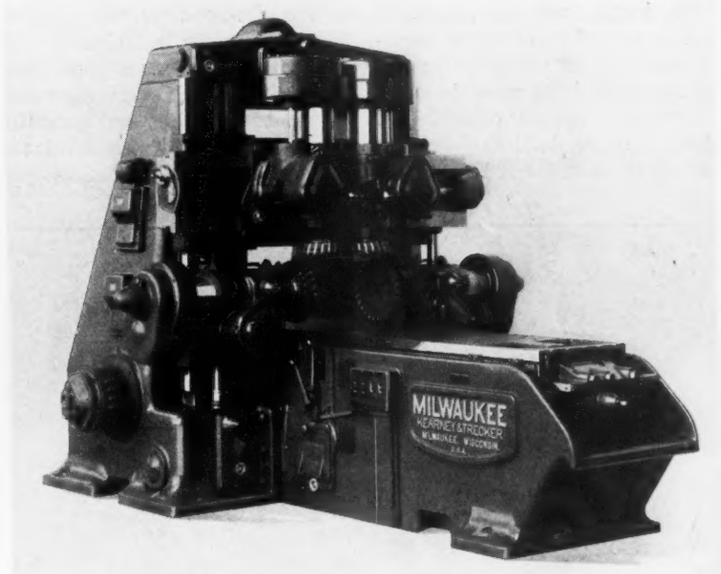
The unit method of construction employed enables the machine to be built in three different widths and with various lengths of feed. The No. 2200 series has a table 22 inches wide, the No. 3000 series a table 30 inches wide, and the No. 4200 series a table 42 inches wide. All three series can be furnished with either 7, 9, or 11 feet of longitudinal table travel.

Four spindles are furnished regularly, two of the vertical type on the cross-rail, and two of the horizontal type, one on each side housing. However, different spindle combinations can be selected to suit requirements. All spindles can be supplied either in a fixed or a swiveling design. If two vertical spindles of the latter type are furnished, they can be swiveled 45 degrees toward each other or 25 degrees away from each other. Each spindle has a quill adjustment of 7 inches.

Separate spindle speed-change gears giving ten speed changes, and separate reverse gears, are furnished for each spindle. Any one of three spindle speed ranges can be provided, from 20 to 135 revolutions per minute for use in cutting steel or cast iron with high-speed steel cutters; from 50 to 350 revolutions per minute for milling cylinder blocks, crankcases, and other iron castings by means of tungsten-carbide cutters; and from 75 to 500 revolutions per minute for use in milling aluminum with tungsten-carbide cutters. The highest speed range can also be used for some cast-iron and steel work when small cutters are employed.

Four motors are used for driving the machine units, all of which are controlled from a single panel at the side of the bed. One motor drives all the spindles; another furnishes power for the table feed and the power rapid traverse; the third motor raises and lowers the cross-rail; while the fourth operates a coolant pump.

On all the machines, the distance from the top of the table to the vertical spindles is adjustable from 0 to 25 inches, and the distance from the top of the table to the center line of the horizontal spindles, from 0 to 19 inches. Extended upright housings can be furnished to increase these heights.



Rail-type Milling Machine Recently Developed by the Kearney & Trecker Corporation

Fig. 1. Lanco, Landex, and Landmatic Hardened and Ground Die-heads Intended for High-production Service on Work Held to Close Thread Tolerances

Landis Hardened and Ground Die-Heads

A series of die-heads that are hardened and ground throughout has been developed by the Landis Machine Co., Waynesboro, Pa., to supplement, but not to supersede, the present line made by the concern. The new die-heads are built in the following types and sizes: 5/8- and 7/8-inch Lanco heads (Type V) for hand-operated threading machines of the bolt cutter type; 5/8-, 7/8-, and 1 1/4-inch Landex heads (Type L) for automatic screw machines; and 5/8-, 7/8-, and 1 1/4-inch Landmatic heads (Type H) for turret lathes. These heads are recommended by the manufacturer for high-production or heavy-duty service and for work that must be held to extremely close thread limits.

The new heads differ greatly from the conventional Landis design, but the chasers are the same as before and are interchangeable with those of the heads now in use. The chaser-holders operate in dovetail slots ground in the face of the body. They are designed to facilitate the changing of chasers, to permit unusually accurate setting of the chasers in relation to the cutting center, and to insure a rigid chaser support. A comparatively short clamp operated by a hollow-head screw, retains each chaser in its holder.

The chaser seat in the holder is ground at an angle to the face of the die-head, so as to incline the chaser in relation to the work. This practice of controlling the helix angle in the holder simplifies the setting and grinding of chasers, permits chaser interchangeability, and makes possible the use of chasers of a given pitch for threading any diameter of work within the range of the die-head.

The head is opened by moving the chaser-holders. As will be seen in Fig. 2, the position of the chaser-holders is controlled by prongs on a closing ring. These prongs act as cams. Movement of the closing ring is effected by spring pressure and controlled by a locking ring. To close the die-head, the locking ring is rotated on the head body, tapered surfaces forcing the closing ring forward.

Opening and closing of the Lanco and Landex heads are effected through a yoke. The Landmatic head can be opened and closed automatically or by hand. These die-heads can be adjusted for size by a threaded collar. Adjustments as fine as 0.00025 inch are possible.

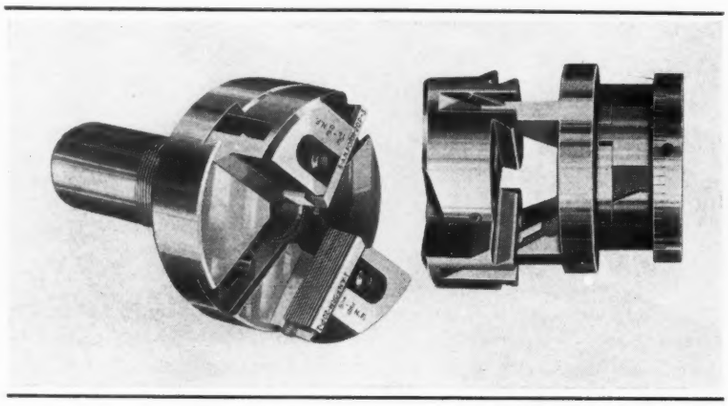
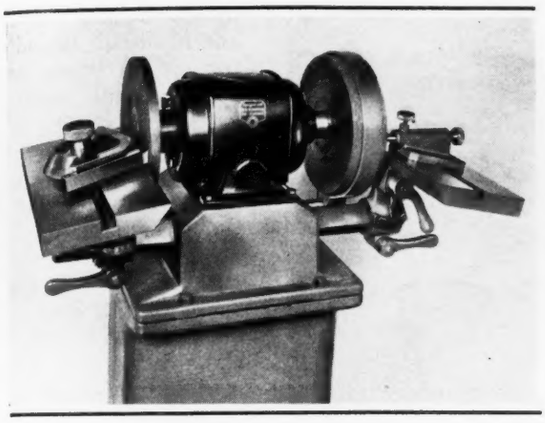


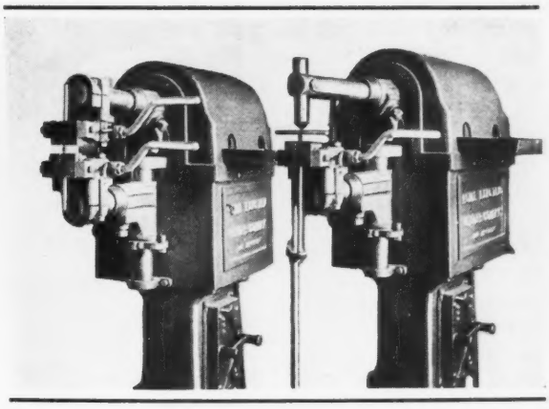
Fig. 2. Disassembly of One of the New Landis Die-heads

Diamond-Cutting and Grinding Machine

A machine designed for sharpening tungsten- and tantalum-carbide tipped tools, which is equipped with a ring-type grinding wheel and a diamond-dust impregnated plate, has been designed by the Carbide Engineering Corporation, 356 E. Congress St., Detroit, Mich. The new machine is equipped with adjustable grinding tables, a universal angle-grinding fixture, and a diamond-holder for truing the



Machine with Grinding Wheel and Diamond-impregnated Plate for Sharpening Carbide Tools



Using One and Two Tee-welding Attachments on an Acme Electric Spot-welding Machine

grinding wheel. The wheel is mounted on a steel plate, so that practically all the abrasive can be used. Carbide tools used for light cuts can be resharpened on the diamond plate without a grinding operation. The grinding wheel and diamond plate are 8 inches in diameter.

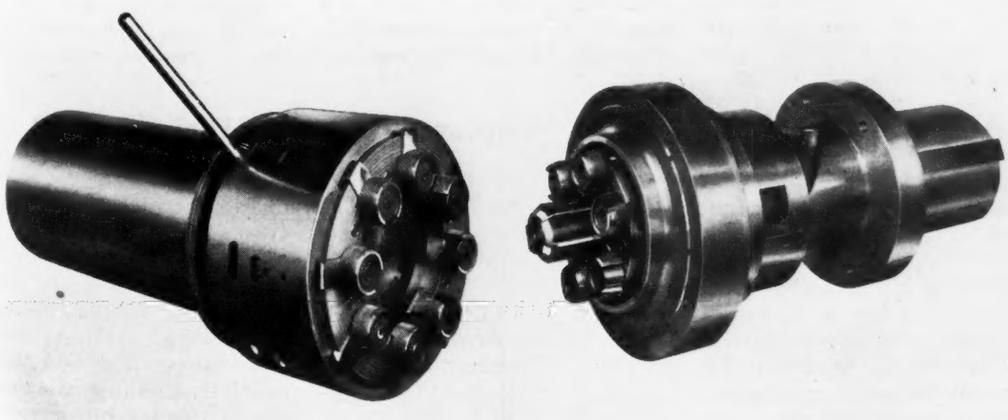
Acme Tee-Welding Attachment

An attachment for spot-welding machines which is designed to facilitate the fabrication of such parts as refrigerator shelves, stove shelves, and bird cages has been placed on the market by the Acme Electric Welder Co., 5621-23 Pacific Blvd., Huntington Park, Calif. At the right in the illustration, one of these attachments is shown being used on the lower horn of a spot welder for tee-welding. For butt-welding operations, two attachments should be used, one on the lower horn and one on the upper horn, as shown at the left in the illustration.

This attachment is constructed of bronze, with solid copper reversible and replaceable die-blocks. The jaws will accommodate any size of wire from No. 16 gage up to 1/2 inch in diameter. The jaws are actuated by a cam on the offset handle, which permits fast operation and provides for rigid clamping. All movable parts are made of hardened steel. The attachment can be operated either right- or left-handed and upside down.

National Acme Circular-Chaser Cutting Tools

The constant trend toward a higher degree of accuracy in cutting taper threads on pipe and tubing, particularly in the oil industry, has led to the more accurate standards established by the American Petroleum Institute. To meet these requirements in a commercial way, the National Acme Co., 170 E. 131st St., Cleveland, Ohio, has produced a line of circular-chaser



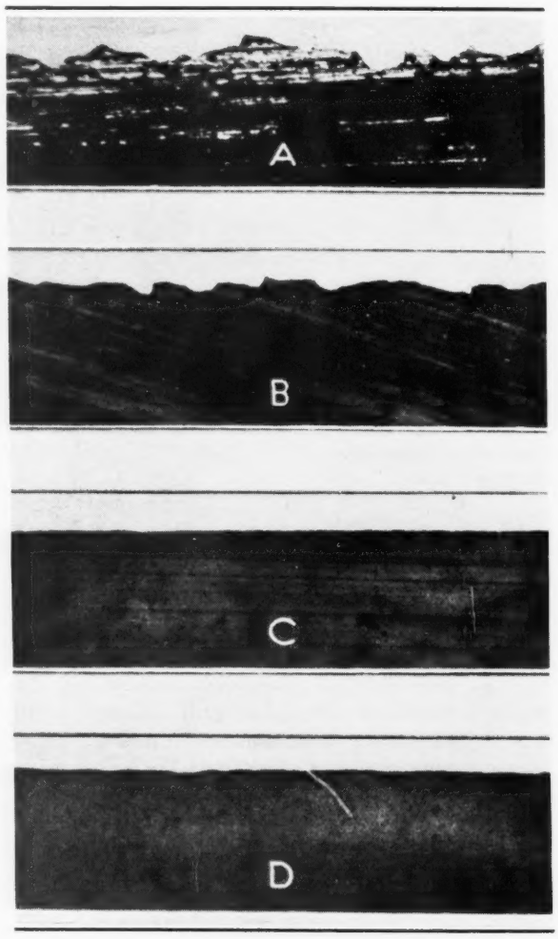
Expanding Die-head and Receding Tap, Both with Circular Chasers, Brought out by the National Acme Co. to Meet New Standards of Accuracy in Cutting Pipe Threads

receding taps ranging from 4 to 13 3/8 inches, and a line of circular-chaser expanding dies ranging from 1 to 13 3/8 inches. Larger sizes of these tools can be made.

The fundamental idea of the circular chaser is to present a large amount of steel back of the cutting edge so as to carry away cutting heat and afford a rigid support to the cutting edge. It is claimed that with this design more threads can be cut for each grind of the chaser. Also, because practically the entire periphery of the chaser can be used without a change in the thread form, many more grinds are possible before the chaser must be discarded than with other kinds of thread cutters.

The chasers are mounted on a serrated bushing which provides a means of advancing them for grinding when the cutting edges become dull. After sharpening, the chasers are checked with a micrometer gage while they are on the same blocks that support them in the die-head. With this arrangement, complicated adjustments are eliminated. There is only one adjustment on the die-head, and that is for pitch diameter. A set of chasers and blocks can be taken out of the die-head and replaced by a sharpened set, and production resumed with minimum delay.

Chasers of a certain pitch can be used for a wide range of diameters. In the die-head construction, each chaser block is held firmly against a hardened and ground gib. By replacing the gibs, the die-head can be changed to suit a different taper. In the tap construction, the taper is established by holding each chaser block against a center core-piece.



Rough-ground, Finish-ground, and Lapped Tungsten-carbide Cutting Edges are Shown at A, B, and C, Respectively. A Razor Edge is Shown at D

Spedia Lapping Wheels and Hand Laps

Thomas Prosser & Son, 15 Gold St., New York City, are now the representatives of A. C. Wickman, Ltd., of England, for Spedia lapping wheels and hand laps intended for use on Widia and other cemented carbide cutting tools. The lapping wheels quickly produce the same fine finish on cutting edges that has been obtainable heretofore only with a cast-iron disk charged with diamond dust. The illustration shows at *A* a greatly magnified rough-ground tungsten-carbide cutting edge, at *B* a cutting edge produced by an ordinary finish-grinding wheel, and at *C* a cutting edge obtained by a Spedia lapping wheel. A razor edge is illustrated at *D* for comparison.

Ordinary finish-grinding of tungsten-carbide tools is suitable for much work on cast iron, etc., but for a fine finish and especially on non-ferrous materials, lapping of the cutting edge gives longer life, higher production, and a much better finish. Spedia wheels are stocked in cup form, 3 inches in diameter by 7/8 inch deep, with a 3/8-inch rim and a 1/2-inch hole.

Spedia hand laps can be used for finishing new reamer blades, milling cutters, and similar tools. They can also be used for touching up tools in the machine to obtain longer life between grinds.

Improved Features of High Speed Riveting Hammers

The High Speed Hammer Co., Inc., 305-321 Norton St., Rochester, N. Y., manufacturer of rotary-type flexible-blow riveting hammers, has recently made a number of improvements in these machines. Hammers already in use can be modernized by applying the improved features.

The most important improvement is in the design of the rubber cushion *A* in the upper view of Fig. 2, which is interposed between the front end of hickory helve *B* and the reciprocating ram or hammer *C*. In previous designs, the rubber cushion was held between the helve and ram in a manner that necessitated a relatively tight assembly and the use of tubular rubber cushions. With that design, friction occurred at several points and there was a binding effect which

restricted the rotation of the reciprocating ram. Undue wear on various working parts resulted. It was also necessary to have a stem protrude from the top of the ram to hold the tubular cushion in position.

In the new design, the rubber cushion is rigidly secured to the under side of the helve so that the helve and cushion move as one unit. The friction and impact incident to striking the ram are confined to the lower face of the cushion. This reduces friction to a minimum and prolongs the life of the cushion ten times or more. The new assembly does not require a close tolerance in the length of the strap which holds the ram assembled to the helve and cushion.

The solid cushion that is now employed instead of the tubular cushion provides a greater volume of resilient material. Since the cushion is secured to the helve independently of the means used for connecting the ram to the helve, the ram is relieved of the former binding effect, and hence, it can rotate more freely when rotation is desired. The helve need not be disassembled to replace the rubber cushion.

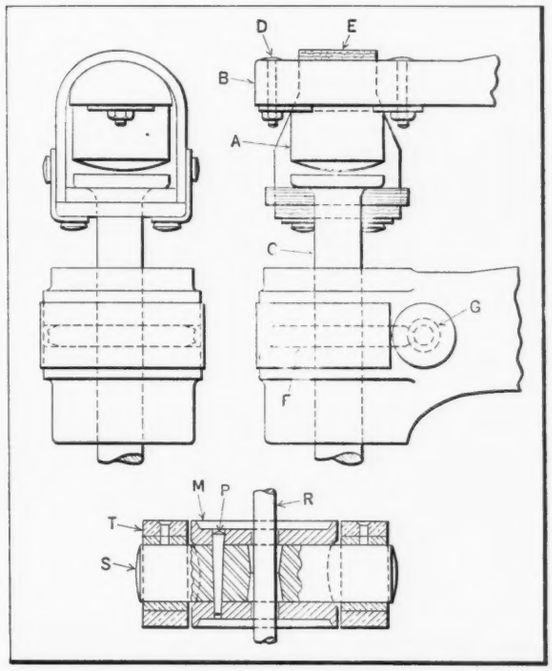


Fig. 2. Construction of the Improved Front and Rear Cushion Assemblies of High Speed Hammers

In previous designs of High Speed riveting hammers, the rear rubber cushions were held by two rubber retainers and a wrist-pin interposed between them. The assembly was held by a connecting-rod. The wrist-pin had a tendency to float excessively in the rubber retainers, coming into contact with the connecting-rod and causing wear.

This rear unit has been redesigned as shown in the bottom view of Fig. 2. There is now a center rubber retainer *M*, made in one part, which is doweled by a pin *P* that extends through wrist-pin *S*. With this construction, there is no floating of the wrist-pin in the rubber retainer, the two parts being held in a constant relative position. Floating of the wrist-pin is confined to the bearings of vibrator *T*. Wear of the connecting-rod from oscillation of the wrist-pin has been obviated.

The improvements in the front and rear cushion assemblies are both covered by patents.

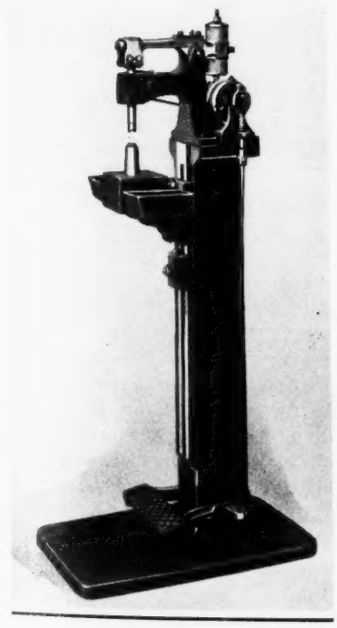


Fig. 1. High Speed Riveting Hammer with Recent Improvements

Hallanger Industrial Oiler

An oiling device designed to supply predetermined quantities of oil indefinitely — one drop a minute, more or less, as desired—is a recent product of Hallanger Oiler Sales, Division of the National Stamping Co., 630 St. Jean Ave., Detroit, Mich. The capacity of this oiler is sufficient for a ten-hour shift, whether oils of from 150 to 250 viscosity are used or the lighter oils of from 90 to 100 viscosity. The oil reservoir is practically sealed against the entrance of dust.

These oilers are made of heavy-gage steel stampings. An upper shell guards the glass.

Oiler Designed to Supply a Predetermined Amount of Oil Indefinitely

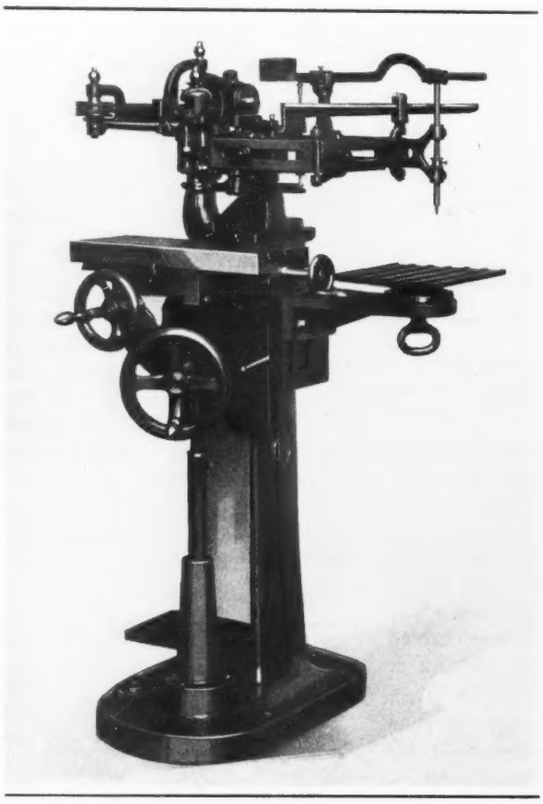
Hisgen-Nube Universal Die-Sinking, Engraving, and Profiling Machine

A universal pantograph type of die-sinking, profiling, and engraving machine embodying several important improvements as compared with the machine described in April MACHINERY on page 533, has recently been developed by the Hisgen-Nube Machine Co., 6250 Harper Ave., Chicago, Ill. Like the previous machine, the improved model can be employed for three-dimensional as well as two-dimensional operations. The vertical movement is 2 inches, whereas the earlier model had an up and down movement of only 1/4 inch.

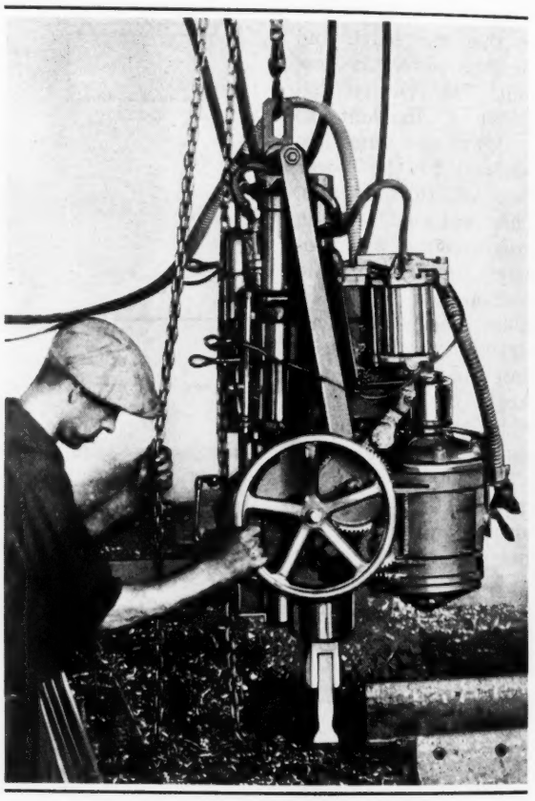
On the new machine, the pattern table or copy-holder can be adjusted vertically to accommodate copies or models up to 12 inches high, whereas on the previous machine, models 1 inch thick only could be used. The copy-holder is so arranged that the operator sits between the model and the work, where he can clearly see what he is doing.

The concave and convex forming guide has also been improved. It can be adjusted right over the spindle. The fork that holds the entire pantograph and lever system can be swung clear around, through 360 degrees, a feature that saves time in setting up.

The machine column is much heavier than before, weighing 1435 pounds as against 750 pounds. The spindle accommodates straight-shank cutters up to 3/8 inch. An electrical tracer can be supplied.



Hisgen-Nube Die-sinking, Engraving, and Profiling Machine of Improved Design



Artos Automatic Drilling Machine for Use in Fabricating Structural Steel

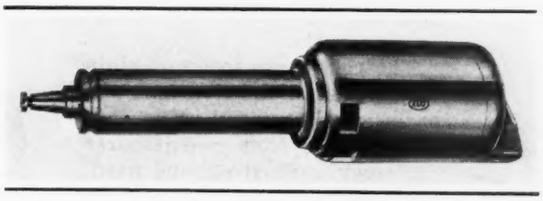
Automatic Drilling Machine for Structural Steel Work

A high-speed automatic drilling machine designed to simplify the drilling of the large number of rivet holes often required in fabricating structural steel assemblies is being introduced on the market by the Artos Engineering Co., 327 E. Brown St., Milwaukee, Wis. This equipment, as illustrated, consists of a drill head suspended from a swinging horizontal support which is made up of structural steel and mounted in ball bearings. The support can be mounted on a runway along the wall or on columns, similar to a crane runway. The drill head is counterbalanced to enable the operator to move it with the least possible effort from one hole punch mark to another.

The drill head is held in a cradle to permit it to be easily changed from a vertical to a horizontal position, and vice

versa. It is automatically clamped to the material that is to be drilled before the tool penetrates into the work. In drilling curved structures, regardless of the hole location, the drill will always penetrate perpendicularly relative to the surface. The clamp is quickly adjustable to suit the thickness of the material handled. The drill head unit includes a motor, air cylinder, gearing, valve control, spindle, etc.

In drilling a hole, the operator simply moves the drill head over the punch mark, locates the drill point by means of a handwheel, and presses a button. The drill head is then automatically clamped to the steel and drilling starts. After the hole has been completed, the drill is automatically withdrawn.



Ex-Cell-O Spindle with In-built Motor Designed for the Monarch No. 2 Surface Grinder

Automatic Motor Control Equipment

Thermostats designed to protect motor-driven and other machinery from breakdowns due to overloaded bearings have been developed by the Electric Controller & Mfg. Co., 2720 E. 79th St., Cleveland, Ohio. These thermostats are particularly suited for use on motor-driven fans, conveyor systems, compressors, refrigerating machines, automatic pumping stations, etc.

Two types of these thermostats are illustrated. They consist of a sealed metallic bulb which contains a volatile liquid. This bulb is connected directly or through flexible copper tubing to the one-piece seamless metal bellows. A rise in the temperature of a bearing will cause the volatile liquid to expand and generate pressure in the bulb. This pressure, in turn, will be transmitted to the bellows, causing electrical contacts to open and stop the machine.

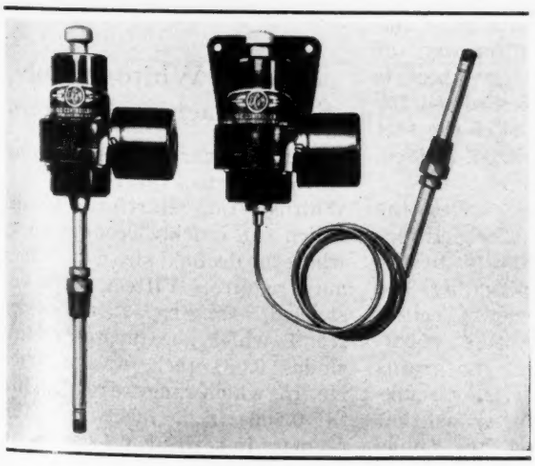
Ex-Cell-O Motor-Driven Spindles for Monarch Surface Grinders

An in-built direct motor-driven spindle manufactured by the Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich., is supplied as standard equipment on the new No. 2 surface grinder built by the Monarch Machine Tool Co., Sidney, Ohio. The spindle and motor are enclosed in one body, forming a complete unit as illustrated. The spindle is equipped with two Ex-Cell-O precision ball bearings. Each bearing has been developed to predetermined radial and end thrust limits and is provided with selected balls.

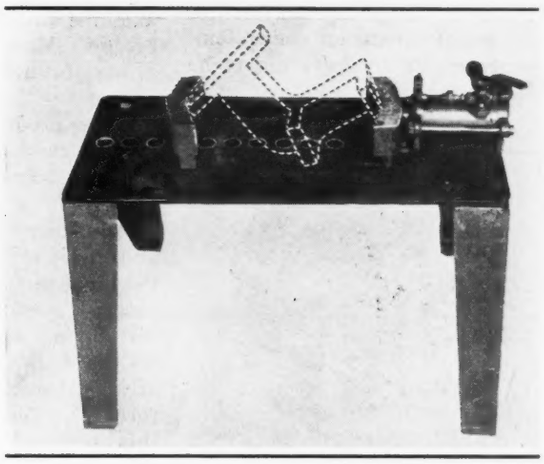
On the wheel end of the spindle is a guard to keep water, dirt, and other foreign material from entering the spindle and causing the bearings to fail. The motor is rated at 1 horsepower, and runs at 3500 revolutions per minute.

Casting Holding Device

A device designed to hold irregular shaped castings for grinding and chipping operations has just been placed on the market by the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J. This device, which is known as the "Sullivan casting holder," is air-operated. It is particularly designed for light work that is difficult to hold on a standard floor stand. The jaws are quickly adjustable to suit the work. The table has a steel-plate top measuring 44 by 18 inches. The unit weighs about 160 pounds.



Thermostats that will Shut down Machines if Bearings become Too Hot



Sullivan Casting Holder which Facilitates Grinding and Chipping Operations

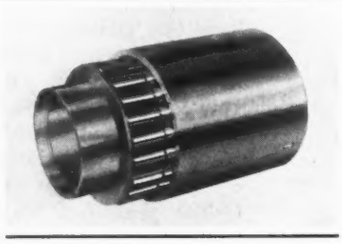


Fig. 1. Fafnir Roller Bearing with Solid Rolls

Fafnir Industrial Roller Bearings

Roller bearings designed primarily for heavy duty service in industrial applications have been developed by the Fafnir Bearing Co., New Britain, Conn., in sizes from 1/4-inch shaft diameter upward, to meet any need for which bearings of this type are suitable. The rollers of these bearings, as may be seen in Fig. 1, are held in place in the cage by spacer bars. This construction permits the use of solid rollers, and as a result, a high capacity and long life are claimed. The spacer bars are riveted to the end rings and keep the rollers permanently aligned.

An additional feature is the use of two-part rollers to prevent any possibility of skewing. The entire roller bearing assembly is made with a fixed radial clearance to allow for the expansion that takes place when the inner ring is shrunk on the shaft. This clearance also permits a certain amount of expansion due to temperature rise in operation to be taken care of without seriously affecting the relationship of the bearing parts.

The rollers are made of high-carbon chromium steel and are hardened throughout. The cage is fabricated from rolled spacer bar stock, carburized, and hardened end rings.

Fig. 2 shows a pillow block equipped with one of the new Fafnir roller bearings. In addition, a standard single-row radial ball bearing is provided to take care of thrust loads in either direction. Bolted-on end covers enable easy assembly and disassembly of this pillow block.

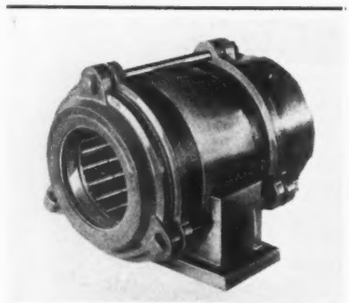
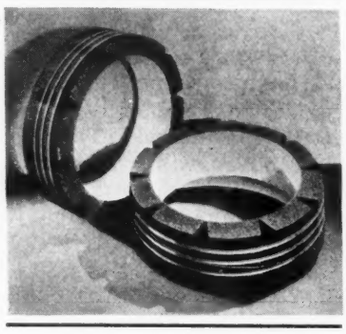


Fig. 2. Pillow Block with Fafnir Roller and Ball Bearings

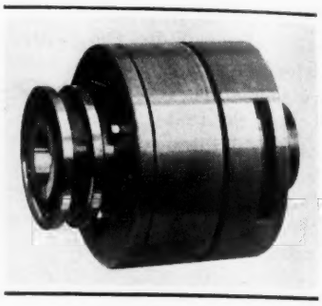


Blanchard One-piece Grinding Wheels with External Notches

Blanchard Sectored Wheel

A one-piece grinding wheel that is said to possess all the desirable features of a segment wheel has been added to the line of grinding wheels and segments manufactured by the Blanchard Machine Co., 64 State St., Cambridge, Mass. Uniformity of grade throughout the wheel is one of the features claimed for the new product, due to the fact that the wheel is mixed, molded, and baked as one piece.

The inner wall carries the water down to the wheel face and gives a continuity to the face that prevents pounding. The external notches never collect dirt. They are shaped to equalize the work done by the grains of abrasives at different circumferences. Tests have shown that this sectored wheel has ample strength for heavy-duty service. It is made for use on the No. 16 Blanchard surface grinder.



Magnetic Clutch which can be Operated in Oil or Water

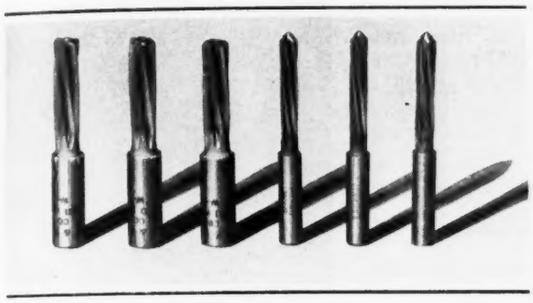
Small-Size Multiple-Disk Magnetic Clutches

The Magnetic Mfg. Co., Milwaukee, Wis., has designed a line of multiple-disk magnetic clutches ranging from 6 inches in diameter upward, for both wet and dry operation. This Style C line is supplementary to the larger Style B clutches made by the concern.

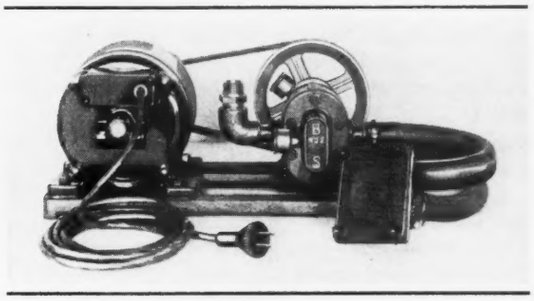
The new clutches are believed by the manufacturer to be the first magnetic clutches offered to the trade that can be operated in oil, water, or similar liquids. Though of small diameter, they have a high torque capacity and ample friction area. A one-point adjustment to compensate for lining wear is another feature. Complete impregnation against moisture is provided. Collector rings, brush-holders, and brushes are supplied as part of the clutches. They are built with from two to eight disks.

Pratt & Whitney Stub Screw-Machine Reamers

Stub reamer blanks are now carried in stock by the Pratt & Whitney Co., Hartford, Conn., which can quickly be finished to whatever decimal size a customer may require. Fifteen sizes are stocked, ranging from series No. 1, which goes up to and includes 0.081 inch, up to series No. 15, which ranges from 0.4701 to 0.500 inch, inclusive. The reamers in series No. 1 have four flutes, and the others six flutes. All flutes are 7-degree, left-hand spiral.



Reamers Stocked in Blank Sizes by the Pratt & Whitney Co. and Finished to Decimal Diameters



Brown & Sharpe Pump which is Suitable for Such Service as Emptying Coolant Tanks

This new line of stub reamers is designed particularly for automatic screw machine work and for jobs requiring short tools on drilling machines, hand screw machines, tapping machines, etc. The reamers are made of high-speed steel and are heat-treated for toughness and durability. By merely using a pin through a hole in the shank of the reamer, a simple floating holder can be obtained.

Portable Oxy-Acetylene Cutting Machine

A Secator portable cutting machine weighing only 43 pounds has been added to the Oxweld line of apparatus manufactured by the Linde Air Products Co., 30 E. 42nd St., New York City. This equipment is intended for plate shops, tank builders, steel plants, and other moderate-sized metal-working plants.

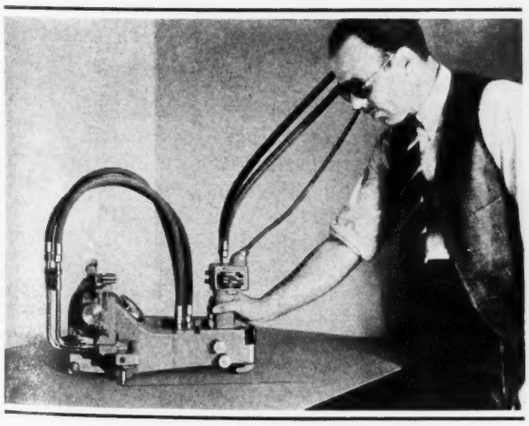
The machine consists essentially of an Oxweld blow-pipe mounted on an electrically driven, air-cooled and dust-proof chassis. It will run either on a 1 1/2-inch angle-iron track, furnished with the equipment, or on any relatively smooth plate. Straight-line cutting is performed automatically when the equipment is run on the track. For cutting simple shapes, the machine can be guided with a hand grip, while for automatic circle cutting, a center and a radius rod are furnished. The machine is driven by a universal motor.

Brown & Sharpe Drain Pump

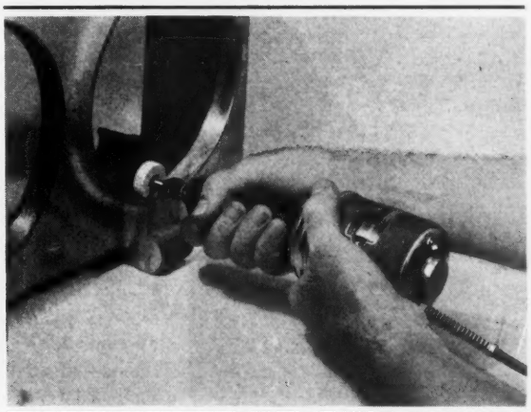
A pump that can be used around industrial plants for emptying coolant tanks, transferring cutting and lubricating oils from drums to reservoirs in machines, transferring various other liquids, and for plant maintenance where sumps or plumbing lines must be drained is shown in the illustration. This pump is a recent addition to the line of the Brown & Sharpe Mfg. Co., Providence, R. I. It has a capacity of from 300 to 350 gallons per hour and is intended for pressures up to 20 pounds per square inch. Its designation is No. 172.

"Hand-EE" Portable Electric Grinder

Tool-room grinding of dies, molds, and other accurate parts, smoothing of castings, and other operations can be performed with a high-speed portable electric tool being introduced on the market by "Chicago Wheel," 1101 W. Monroe St., Chicago, Ill. The compact design of this tool permits its use in many inaccessible places. It can be used for getting



Portable Oxy-acetylene Cutting Machine with Motor-driven Chassis



Using the "Hand-EE" Portable Grinder in the Tool-room

into and around corners and into irregular shaped holes, as well as for grinding at any angle. Three grinding wheels are furnished with the tool, over one hundred shapes and sizes being available to meet practically any need.

A universal motor drives the tool at a maximum speed of 17,000 revolutions per minute. High-speed, dust-sealed ball bearings reduce friction and eliminate overheating. The motor housing is an aluminum casting which extends over the motor shaft. This portion of the casting is encased in a fully insulated cushion grip which gives the operator positive control and unusual flexibility.

Unipower Agitator

An agitator that has been used for several years in equipment manufactured by the Patterson Foundry & Machine Co., East Liverpool, Ohio, has now been made available as a separate unit. This attachment is built in both vertical and horizontal types.

When a motor of 1800 revolutions per minute is supplied, shaft speeds of less than 1 revolution per minute can be secured without the use of gears. This agitator is built in sizes from 40 horsepower down to fractional horsepower sizes. It does not require additional bearings or flexible couplings for installation.

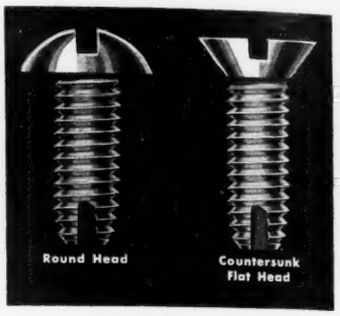
Unipower Agitator Available for Various Applications

Stanley "Flexible-Rigid" Steel Rules

Three pull-push rules recently brought out by Stanley Tools, New Britain, Conn., are shown in the accompanying illustration. The six-foot steel blades of these rules are both rigid and "flexible-rigid" to enable straight lengths, cylinders, or odd shapes to be measured. Each blade can be removed entirely from its case and used for end-to-end measurements if desired. The cases are 2 inches in diameter.

Three Stanley "Push-Pull" Rules with Removable Blades

The No. 3506 rule is provided with an octagonal nickel-plated steel case and has a blade graduated on one of the lower edges. An arrow on the case indicates inside measurements when the end of the blade and the bottom edge of the case abut against the work. The style No. 3306 has a round steel case with a gun-black finish. The blade of this case is graduated on both edges of one side. The style No. 3206 has a round brass-and-steel case with a two-tone chromium-plated finish. The blade of this rule is graduated top and bottom on both sides, giving four scales.



Machine Screws that Tap their Own Holes in Metal

Tapster Self-Tapping Machine Screws

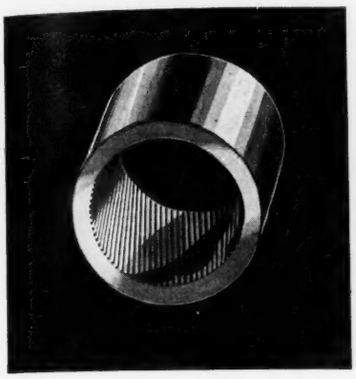
Self-tapping machine screws of hardened steel which have a standard thread, flutes, and twin cutting edges have been placed on the market by the Kellogg Switchboard & Supply Co., 1066 W. Adams St., Chicago, Ill. These screws are intended to replace ordinary machine screws in assembly operations involving the fastening of sheet steel, machined steel, brass, bronze, aluminum, fiber, Bakelite, and similar hard materials. The use of these screws eliminates preliminary tapping operations.

It is claimed that since the screws cut their own thread, the fit is tighter than that of ordinary machine screws in tapped holes. These self-tapping screws are available in all standard sizes with standard heads, as well as with special heads and plated finishes.

Johnson Graphited Bushings

Bronze bushings having cut dovetailed grooves that are filled with a graphite lubricant are a development of the Johnson Bronze Co., 500 Mill St., New Castle, Pa. More than 40 per cent of the bearing surface of these bushings provides a graphite contact with the shaft.

These bushings differ from those described in August, 1931, MACHINERY, page 973, in that their grooves are cut rather than stamped. Also, a much larger assortment of sizes is now avail-



Johnson Graphited Bushing with Cut Lubricant Grooves

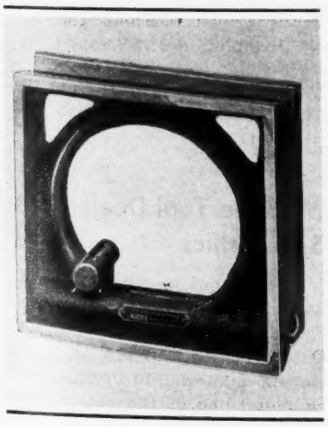
able. The bushings are made from sheet bronze and from bronze castings, depending upon the application for which they are intended.

"Super-Precision" Square Type Level

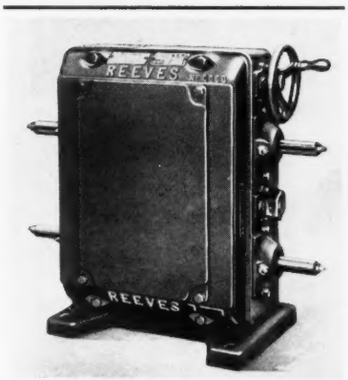
A level of high accuracy has recently been placed on the market by the George Scherr Co., 128 Lafayette St., New York City, for use in the assembly of machine tools and other industrial machinery that must be carefully aligned. An important feature of this level is its rigid square frame. The level can be used for aligning both horizontal and vertical surfaces, as well as shafting.

The accuracy of the longitudinal level is guaranteed to within 0.0005 inch per foot. In circular measurements, the accuracy is within 10 seconds. The sides of the frame are carefully scraped. The secondary cross-level assures that the device will be held in a horizontal position on the work.

On account of the super-sensitivity of the longitudinal level, the temperature of the level, of the work and of the room in which the level is being used should be carefully controlled, so as to guard against inaccurate measurements resulting from differences in temperature.



Square-type Level for Use in the Accurate Assembly of Machinery



Reeves Variable-speed Transmission Only 14 Inches High

Reeves Vertical-Type Variable-Speed Transmission

A completely enclosed vertical design of variable-speed transmission less than 14 inches high has been designed by the Reeves Pulley Co., Columbus, Ind. This No. 0000 unit is particularly recommended for upright installations of limited space and low horsepower requirements, in which severe conditions of service may be encountered. The capacity ratings range from 1/8 to 3/8 horsepower. An infinite speed adjustment is available in ranges from 2 to 1 up to 6 to 1.

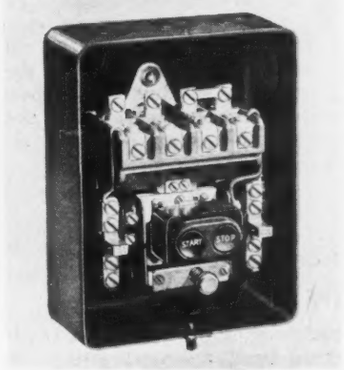
The cast-iron case protects the operating parts from such destructive elements as water, chemical fumes, and abrasives. A centralized force-feed lubrication system is provided. The over-all width of the unit, not including the handwheel, is 11 1/4 inches, and the thickness, including the feet, is 7 7/16 inches. The net weight of the transmission is 70 pounds.

Allen-Bradley Automatic Across-the-Line Switch

A solenoid-operated across-the-line starting switch just brought out by the Allen-Bradley Co., 1311 S. First St., Milwaukee, Wis., is shown in the accompanying illustration. This switch is rated at 5 horsepower 220 volts, and 7 1/2 horsepower 440 to 550 volts, for polyphase motors; and up to 1 1/2 horsepower 110 volts and 3 horsepower 220 volts for single-phase self-starting motors.

The switch is made in three forms as follows: With start and stop push-buttons; without push-buttons for thermostat or remote pilot control; and with a two-way "hand-automatic" switch for "try out" control installations.

Small cabinet dimensions have been obtained by substantially reducing the size of the switching mechanism. Adequate wiring space is provided in the cabinet. Double-break silver alloy contacts are furnished to give a long contact life. A patented hood suppresses the arc so completely that locked rotor currents of motors several times the rating of the switch can be broken without flash-over.



Allen-Bradley Automatic Starting Switch Made in Three Forms

NEWS OF ASSOCIATIONS

American Welding Society Meets in Detroit

The American Welding Society held its fall meeting at the Book-Cadillac Hotel, Detroit, Mich., October 2 to 6, in conjunction with the National Metals Exposition. At the meeting, a great number of papers covering practically every phase of the welding industry were read. Attention was given to welding in making machinery frames, in shipbuilding, and in aircraft. The cutting of metals by gas and the electric arc was also dealt with. One session was devoted to fundamental research in welding, and a special session was devoted to resistance welding. The inspection of welds received attention, and the welding of many recently developed alloys was covered in numerous papers.

Gray Iron Institute Changes Name

The members of the Gray Iron Institute, acting upon recommendations of the board of directors of the Institute, have voted to make certain changes in the by-laws so that the foundry industry might function more efficiently under the National Recovery Act. At the same time, they also voted to change the name of the Gray Iron Institute to the Gray Iron Founders' Society, Inc. The offices are located at Euclid Ave. and E. 43rd St., Cleveland, Ohio.

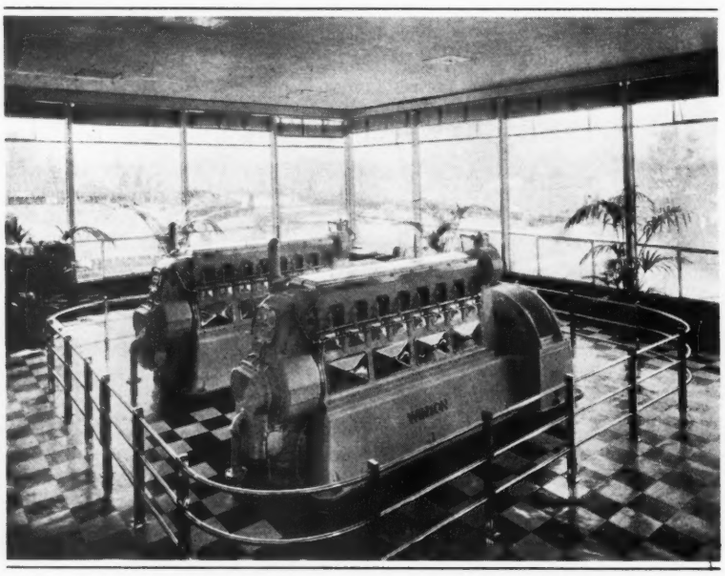
Gear Manufacturers Hold Semi-Annual Meeting

The American Gear Manufacturers Association held its sixteenth semi-annual meeting at Wilkinsburg, Pa., October 17 and 18. Contrary to the customary procedure of the Association, no technical papers were presented, the meeting being devoted primarily to a discussion of the Association NRA code.

The subject of gear merchandising was dealt with in a paper by Francis A. Emmons, general sales manager of Foote Bros. Gear & Machine Co., Chicago, Ill. In dealing with this subject, Mr. Emmons covered the use that gear makers can make of market analysis, advertising, and direct sales promotion.

Howard Dingle, president of the Cleveland Worm & Gear Co., Cleveland, Ohio, spoke on business ethics and fair practices, and dealt specifically with the six unfair trade practices defined in the gear manufacturers' code. Roscoe Seybold, comptroller of the Westinghouse Electric & Mfg. Co., spoke on "NRA and Cost Accounting." He urged the adoption of uniform accounting factors as the only basis for the compilation of accurate selling costs.

The following new members were elected: Chicago Gear Works, Chicago, Ill.; Braun Gear Corporation, Brooklyn, N. Y.; Cleveland Worm & Gear Co., Cleveland, Ohio; DeLaval Steam Turbine Co., Trenton, N. J.; Earle Gear & Machine Co., Philadelphia, Pa.; Ganschow Gear Co., Chicago, Ill.; Illinois Gear & Machine Co., Chicago, Ill.; Union Gear & Machine Co., Boston, Mass.; and Western Gear Works, Seattle, Wash. The following affiliated members were elected: Quaker City Gear Works, Philadelphia, Pa., and the Michigan Gear & Engineering Co., Detroit, Mich.



A Winton Diesel Engine at the Century of Progress Exposition in Chicago. This Engine is of Welded Construction wherever Feasible, Including a Lukenweld Welded-steel Crankcase

Milling and Planing to be Discussed by Engineers

The American Society of Mechanical Engineers will hold its fifty-fourth annual meeting in New York, December 4 to 7, with headquarters in the Engineering Societies Building. In conjunction with the meeting, Stevens Institute of Technology in Hoboken, N. J., has arranged a Frederick W. Taylor memorial celebration for December 7. This celebration includes a series of exhibits and a memorial session.

During the annual meeting, papers will be read pertaining to many phases of mechanical engineering. In the shop practice session, the subjects of milling and planing will have a prominent place. A. C. Danekind, of the General Electric Co., will read a paper entitled "Economics of Planing versus Milling"; R. E. W. Harrison will speak on the subject "Economics of Planing and Milling as Machine Shop Processes"; and Forrest E. Cardullo, of the G. A. Gray Co., will deal with the topic "Comparative Advance of Planers and Milling Machines." Among the papers of interest to machine designers may be mentioned: "Why Has the Machine Designer Failed to Consider Motion Study?" by Allan H. Mogensen; "Appearance in Design," by Joseph Sinel; "Stress Concentration at Fillets," by A. M. Wahl; and "Analysis of Stress in a Helical Spring," by H. C. Perkins.

Machine Tool Dealers Discuss Sales Ethics

The annual meeting of the Associated Machine Tool Dealers was held at the Shoreham Hotel, Washington, D. C., October 25 to 27. The main purpose of the meeting was to discuss the elimination of some of the recognized evils in the machine tool selling business. Addresses were made by Deputy Administrator Malcolm Muir; E. A. Muller, president of the National Machine Tool Builders' Association; Colonel George H. Cherrington; and J. Roy Porter.

NEWS OF THE INDUSTRY

Illinois

GORDON FOX, who has been associated with the Leningrad staff of the Freyn Engineering Co., 310 S. Michigan Ave., Chicago, Ill., has returned to the United States, and will resume his connection with the American activities of this company. Mr. Fox has devoted the last five years to engineering work in the Soviet Union for the Freyn Engineering Co.

JOHN H. CLOUGH has been made president of the General Electric X-Ray Corporation of Chicago (a subsidiary of the General Electric Co., Schenectady, N. Y.), succeeding C. F. SAMMS who has become chairman of the board. Mr. Clough was formerly assistant to the president and was located at Schenectady, where he acted as liaison between the X-ray unit and the research laboratory of the General Electric Co.

IDEAL COMMUTATOR DRESSER CO., Sycamore, Ill., announces that its Chicago office, which is in charge of motor maintenance equipment sales, is now located at 618 W. Lake St. S. S. Callner is local manager.

THOMAS & TILTON, 510 Twenty-seventh St., Rock Island, Ill., announce the opening of a consulting engineering office to serve the mechanical engineering field and allied branches.

Michigan and Wisconsin

M. H. STIMSON has been elected president of Mitts & Merrill, Saginaw, Mich., manufacturers of "Giant" keyseaters. Mr. Stimson succeeds the late Sylvanus S. Mitts, one of the founders of Mitts & Merrill. The other officers elected are: OTTO SCHUPP, vice-president; PERRY SHORTS, treasurer; and EMIL TESSIN, secretary.

B. A. JOHNSTON, formerly assistant sales manager for the Continental Tool Works Division of the Ex-Cell-O Aircraft & Tool Corporation, Detroit, Mich., has been appointed sales manager for the products manufactured and marketed exclusively by the Swedish Gage Co. of America, 7310 Woodward Ave., Detroit, Mich.

CHARLES F. NORTON, former vice-president and general manager of the Howell Electric Motors Co., 408-16 N. Roosevelt Ave., Howell, Mich., has become associated with the Louis Allis Co., Milwaukee, Wis., in an executive sales capacity.

New York and Massachusetts

DELMAR G. ROOS, chief engineer of the Studebaker Corporation, has been nominated president of the Society of Automotive Engineers for the year 1934. Mr. Roos has been connected with the automotive industry continuously since his graduation from Cornell University in 1911, having served in various capacities with the Locomobile Co. of America, the Marmon Motor Car Co., and the Studebaker Corporation. He has been prominent in the work of the Society of Automotive Engineers for many years, serving on a number of important committees, and was vice-president in 1932.

FEDERATED SALES SERVICE, Boston, Mass., has appointed CHARLES W. PARKER representative for the company in the upper part of the state of New York, Vermont, western Massachusetts, and part of Pennsylvania. Mr. Parker's office is located at 90 State St., Albany, N. Y. He was formerly representative for the Alexander Hamilton Institute in northern New York state.

THE NATIONAL INSTITUTE OF USED MACHINERY AND EQUIPMENT DEALERS has been incorporated, with headquarters at 285 Madison Ave., New York City. Charles A. Simmons of the Simmons Machine Tool Corporation, Albany, N. Y., is temporary president.

DAVID FINDLAY was elected vice-president of the L. S. Starrett Co., Athol, Mass., by the board of directors, following the last annual meeting of the stockholders Mr. Findlay has been general sales manager for many years and will continue to serve in that capacity, in addition to assuming the duties of vice-president.

Ohio and Kentucky

AMERICAN ROLLING MILL CO., Middletown, Ohio, for some time past has been engaged in experimental work on stainless-steel alloys, and special stainless steel production equipment has been designed and built. The company announces that it is now ready to manufacture and distribute stainless-steel sheets, strips, and plates. Two grades will be manufactured—one intended for automobile parts, furnace parts, nitric-acid and oil-refining equipment, and oil-burner parts; the other grade will be applicable to airplane parts, baking, laundry and dairy machinery, beer barrels, hotel, restaurant, and kitchen equipment, etc.

EMMETT K. CONNEELY has been appointed manager of railroad sales for the Republic Steel Corporation, Youngstown, Ohio. Mr. Conneely served in various capacities with the Pittsburgh & Lake Erie Railroad during his early business life. Later he was connected, successively, with the Standard Steel Car Co., the New York Air Brake Co., and the Pullman Co., in the capacity of vice-president. He will make his headquarters at the general offices of the Republic Steel Corporation at Youngstown.

LLOYD JONES, formerly manager of the Salem, Ohio, Works of the E. W. Bliss Co., Brooklyn, N. Y., has resigned and is succeeded by L. W. NASH, who has been connected with the company for a number of years as chief designing engineer in the rolling mill department at the Salem Works.

LOUIS STEINFURTH, of East Cleveland, Ohio, formerly chief engineer and assistant manager of the Economy Engineering Co., Willoughby, Ohio, manufacturer of special automatic machinery, has severed his connection with that concern.

FRANKLIN G. SMITH, president of the Osborn Mfg. Co., Cleveland, Ohio, has been elected a director of the Foundry Equipment Manufacturers Association.

HOMESTEAD VALVE MFG. CO., INC., Coraopolis, Pa., has appointed D. W. LAWLER, 1911 Rutherford Ave., Louisville, Ky., exclusive representative in the Louisville district for the sale of the "Hypressure Jenny"—a vapor spray machine for automotive, industrial, aeronautical, and building cleaning.

Pennsylvania

JAMES T. CASTLE, 424 First Ave., Pittsburgh, Pa., has been appointed district representative for western Pennsylvania, northern West Virginia, and the border counties of Ohio by Roots-Connersville-Wilbraham, Connersville, Ind., manufacturers of blowers, pumps, meters, etc. Mr. Castle succeeds the late F. F. Woods.

R. L. FOOTE has been appointed head of the new engineering service department of the Synthane Corporation, Oaks, Pa., manufacturer of Synthane Laminated Bakelite. Mr. Foote's work will consist of developing engineering applications of Synthane. He will make his headquarters at the Oaks office.

E. F. GENE LENOIR has been appointed representative for the Louis Allis Co., Allentown, Pa., manufacturer of direct- and alternating-current motors. Mr. LeNoir was formerly president of the Union Electric Mfg. Co. and has been actively connected with the electric industry for about fifteen years.

Texas

FALK CORPORATION, Milwaukee, Wis., manufacturer of transmission machinery, including gears, speed reducers, Motoreducers, and flexible couplings, has appointed T. F. SCANNELL, formerly St. Louis representative of the company, representative in the Dallas, Tex., territory. Mr. Scannell will have charge of oil field sales in Texas and Oklahoma. His office will be located at 1410 Magnolia Building, Dallas. The St. Louis territory has been taken over by FITCH S. BOSWORTH, 5475 Cabanne Ave., St. Louis.

Washington, D. C.

GILBERT L. YETTER, formerly materials engineer in the Bureau of Construction and Repair, Navy Department, has been appointed welding engineer for the Bureau of Reclamation, Department of the Interior, assigned to the Boulder Canyon Project. Mr. Yetter is supervising the inspection of the fabrication of the welded-steel penstocks being manufactured for the project.

COMING EVENTS

DECEMBER 4-7—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in the Engineering Societies Building, New York. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

JANUARY 6-13, 1934—Thirty-fourth annual AUTOMOBILE SHOW at the Grand Central Palace, New York City, under the auspices of the National Automobile Chamber of Commerce, 366 Madison Ave., New York City.

JANUARY 22-25—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at Detroit, Mich. John A. C. Warner, general manager, 29 W. 39th St., New York City.

JANUARY 27-FEBRUARY 3—AUTOMOBILE SHOW at the Coliseum, Chicago, Ill., under the auspices of the National Automobile Chamber of Commerce, 366 Madison Ave., New York City.

OCTOBER 22-26, 1934—Annual meeting of the AMERICAN FOUNDRYMEN'S ASSOCIATION and Fifth International Foundry Congress and Exposition in the New Auditorium, Philadelphia, Pa. C. E. Hoyt, executive secretary-treasurer, 222 W. Adams St., Chicago, Ill.

OBITUARIES

Charles Piez

Charles Piez, chairman of the board of the Link-Belt Co., Chicago, Ill., and a past president of the American Society of Mechanical Engineers, died of pneumonia October 2 at the Garfield Hospital, Washington, D. C., at the age of sixty-seven years.

Mr. Piez was born in Germany in 1866, of naturalized American parents. He

Charles Piez

grew up in the United States and received his engineering education at the School of Mines of Columbia University. Like many other men who later become leaders in the business and engineering world, his education was paid for largely through his own earnings.

Immediately after his graduation in 1889, he entered the employ of the Link-Belt Engineering Co. in Philadelphia, as a draftsman. Seventeen years later, in 1906, after having held the positions of chief engineer and general manager of the Philadelphia works of the company, he was elected president of a consolidated organization of three related companies—the Link-Belt Machinery Co. of Chicago, the Ewart Mfg. Co. of Indianapolis, and the Link-Belt Engineering Co. of Philadelphia. The consolidation was named the Link-Belt Co., which, under Mr. Piez's management, has become widely known as a successful engineering and manufacturing enterprise.

In 1917, Mr. Piez was appointed vice-president and general manager of the United States Shipping Board Emergency Fleet Corporation to carry out the nation's shipbuilding program. As the chief executive of this mammoth enterprise, of which he later succeeded Charles M. Schwab as director general, Mr. Piez advised upon and directed the expenditure of three billion dollars and the efforts of over six hundred thousand people employed in the shipyards and in the fabricating plants and industries furnishing supplies to the yards. In 1919, Mr. Piez resigned to return to private business.

He continued as president of the Link-Belt Co. until 1924, when he became chairman of the board, remaining its chief executive until ill health in February, 1932, made it necessary for him to give up active participation in the business.

Mr. Piez served as president of the American Society of Mechanical Engineers in 1930. He was also a member of several other engineering societies. Twice he served as president of the Illinois Manufacturers' Association and also as president of the Commercial Club of Chicago. He was a director of the Drexel State Bank of Chicago, and a member of the executive committee of the Museum of Science and Industry, founded by Julius Rosenwald. The honorary degree of Doctor of Commercial Science was conferred upon him by New York University.

Mr. Piez was one of the outstanding men in American industry. To his organizing genius was coupled an unusually friendly personality, which won the admiration and affection of all who came in contact with him.

George E. Randles

George E. Randles, president of the Foote-Burt Co., Cleveland, Ohio, died October 14 at his home in Cleveland Heights, following a long illness.

Mr. Randles, who was fifty-seven years old at the time of his death, was born on a farm near Argyle, N. Y. In 1893 he became a machinist's apprentice with the Pratt & Whitney Co., Hartford, Conn.

George E. Randles

After completing his apprenticeship in 1897, he remained with the company as toolmaker and road demonstrator, and in 1899 and 1900 was European representative of the company. From 1900 to 1906 he was Philadelphia manager of Manning, Maxwell & Moore, Inc. In 1906, he went to Cleveland, joining the Foote-Burt Co. as vice-president and manager. He continued in this capacity until 1919, when he became president of the company.

One of his contributions to the mechanical industry was the line of special drilling, boring, and tapping machines that he developed and that aided in making possible the mass production of automobiles at low cost.

Mr. Randles served as director and treasurer of the National Machine Tool Builders' Association for many years. He was also a director of the National Acme Co. He was a member of the American Society of Mechanical Engineers and the Society of Automotive Engineers.

When the United States entered the World War, Mr. Randles was made director of the Maintenance Division of the Motor Transport Corps of the United States Army. In this capacity he developed and put into successful operation a complete system for the repair and rebuilding of army automotive transport vehicles.

Mr. Randles is survived by his wife, Edith Doan Randles, and three daughters.

John S. Barnes

John S. Barnes, president of the W. F. & John Barnes Co., Rockford, Ill., died suddenly at his home on September 19. His death was due to a cardiac clot. Mr. Barnes was born in 1881, and was fifty-two years old at the time of his death. He was the son of the late John Barnes who, in 1868, was one of the founders of the W. F. & John Barnes Co. This was one of the first machine tool shops in the Middle West.

John S. Barnes

After graduating from the Rockford High School, Mr. Barnes attended Princeton University, from which he graduated with an engineering degree in 1905. After his graduation, he entered the employ of his father's company, and in 1907 was made superintendent of the shop. This position he held for seventeen years until, in 1924, he became president and general manager of the company, which position he held until the time of his death.

In addition to his activity in his own company, Mr. Barnes was interested in other manufacturing enterprises in Rockford. At the time of his death he was a director of the Burd Piston Ring Co. and the Mattison Machine Co. of Rockford. Since 1916 he was a member of the board of trustees of Rockford College, and since 1926 served as president of the board.

Charles E. Thompson

Charles E. Thompson, president of Thompson Products, Inc., Cleveland, Ohio, died October 4 at the Emergency Hospital, Washington, D. C., at the age of sixty-three years, following an attack of acute indigestion. Mr. Thompson was a pioneer in the high-power motor field. His first venture in the production of automotive parts was the result of observing the possibility of making a saving in the manufacture of valves by electrically welding the valve head to the stem. He is also credited with having been the first to introduce alloy steel in the manufacture of valves. He was the first president of the Glenn L. Martin Co., builder of aircraft, and an organizer of the American Airways Corporation. He was always a firm believer in aviation. One of his sons, Edwin G. Thompson, is treasurer and vice-president of Thompson Products, Inc.

NEW BOOKS AND PUBLICATIONS

PROCEDURE HANDBOOK OF ARC WELDING DESIGN AND PRACTICE. 434 pages, 6 by 9 inches; 500 illustrations. Published by the Lincoln Electric Co., Cleveland, Ohio. Price, $1.50 postpaid; foreign copies, $1.85.

This book, brought out by an authority in welding practice, makes available in one volume, complete and up-to-date information on arc welding design and practice. The book is divided into eight principal sections dealing with the following subjects: Welding methods and equipment; technique of welding; procedures, speeds, and costs for welding mild steel; structure and properties of weld metal; weldability of metals; designing for arc-welded steel construction of machinery; designing for arc-welded structures; and typical applications of arc welding in manufacturing, construction, and maintenance. This book should be of value to all welders and heads of welding departments, as well as those responsible for the design of products to be built by welding. The data on procedure, speeds, and welding costs, will be found of particular service in the welding industry.

MECHANICAL CATALOG (1933-1934). 310 pages, 8 1/2 by 11 1/2 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

This is the twenty-third edition of a book containing a collection of catalogue data covering the mechanical engineering field. The data is arranged in alphabetical form under the names of the manufacturers. In addition to the catalogue data, the book contains a classified products index and an index to manufacturers, the latter index being a new feature of the present edition. In this index, under the name of each manufacturer, brief information is given concerning the origin of the company, its activities, and line of products. The classified index, which is printed on yellow paper so that it can be easily located, is arranged alphabetically by products so that all the manufacturers of a given product whose catalogue data is listed in the book, will be found together. This index also includes trade names.

SUPPLEMENT TO POCKET COMPANION (ABRIDGED EDITION)—CB SECTIONS. 24 pages, 6 by 9 inches. Published by the Carnegie Steel Co., Pittsburgh, Pa.

The information on CB sections given in this booklet supersedes that given in all prior publications. It covers the properties and all essential detail dimensions of a modified CB series, the changes in the series being incident to full standardization with other makers of wide-flange beams.

BULLETIN NO. 91 OF THE NATIONAL RESEARCH COUNCIL. 223 pages, 6 3/4 by 9 3/4 inches. Published by the National Research Council, 2101 Constitution Ave., Washington, D. C. Price, $2.

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